

# The Yarkovsky Drift's Influence on NEAs: Trends and Predictions with NEOWISE Measurements

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## ABSTRACT

We used WISE-derived geometric albedos ( $p_V$ ) and diameters, as well as geometric albedos and diameters from the literature, to produce more accurate diurnal Yarkovsky drift predictions for 540 near-Earth asteroids (NEAs) out of the current sample of  $\sim 8800$  known objects. As ten of the twelve objects with the fastest predicted rates have observed arcs of less than a decade, we list upcoming apparitions of these NEAs to facilitate observations.

*Subject headings:* astrometry — minor planets, asteroids — minor planets, asteroids: individual (2010 JG87, 2006 HY51, (137924) 2000 BD19, 2010 HX107, 2002 LT24, (153201) 2000 WO107, 2010 EX11, 2008 EY5, 2006 NL, 2006 MD12, 2010 GQ75) — radiation mechanisms: thermal

## 1. Introduction

The Yarkovsky effect is a non-gravitational force that perturbs the orbits of small bodies, including near-Earth asteroids (NEAs). Despite its small magnitude, it must be included in the calculation of precise asteroid trajectory predictions (Giorgini et al. 2002; Milani et al. 2009), and it is believed to be a key mechanism in the process that delivers asteroids from the main belt to near-Earth space (Bottke et al. 2006).

The diurnal Yarkovsky effect (or drift) is caused by anisotropic re-radiation of absorbed sunlight. It is driven by the thermal properties of an asteroid as well as the amount of absorbed incident radiation. A given surface point on an asteroid observes maximum incident radiation at local noon, but thermal inertia causes the time of maximum emitted radiation (usually at infrared wavelengths) to occur later. Each arriving and departing photon has an associated momentum  $p = E/c$ , where  $E$  is the photon’s energy and  $c$  is the speed of light. Since the body is rotating, the incident radiation is in a different direction than the later emitted radiation, and the body experiences a very small net acceleration. If the body has a prograde spin, the net acceleration has a component aligned with the motion of the body’s orbit, nudging the body away from the sun. Similarly, a body with a retrograde spin will feel an acceleration with a component anti-aligned with its velocity, shifting it towards the sun (Bottke et al. 2006).

There is also a seasonal component to the Yarkovsky effect. The seasonal Yarkovsky effect is largest when an asteroid’s obliquity is  $90^\circ$ , and goes to zero as obliquity approaches  $0^\circ$  or  $180^\circ$  (Bottke et al. 2006). Vokrouhlický et al. (2000) calculated the diurnal and seasonal components of the Yarkovsky effect for several objects, and in all cases the seasonal component was significantly smaller. Even in the case of (1566) Icarus, which has an obliquity equal to  $103^\circ$ , the diurnal component for this object was more than twice the magnitude of the seasonal component over a range of likely thermal conductivities.

There have been few direct measurements of the Yarkovsky drift. Chesley et al. (2003) used radar ranging to make the first direct detection of the Yarkovsky drift. They measured the rate of change of (6489) Golevka’s semi-major axis ( $da/dt$ ) to be of order  $10^{-4}$  AU/Myr. A magnitude  $da/dt$  of  $10^{-3}$  AU/Myr Yarkovsky drift was associated with asteroid 1992 BF by linking modern astrometry with observations from 1952 (Vokrouhlický et al. 2008). Nugent et al. (2012) used an orbit-fitting method to measure Yarkovsky drifts for 54 NEAs, and found an average rate magnitude of  $(10.4 \pm 11.4) \times 10^{-4}$  AU/Myr.

The Yarkovsky effect has been modeled by several researchers (Vokrouhlický et al. (2000); Spitale & Greenberg (2001), for example). Mathematical formulations, such as those by Vokrouhlický et al. (2000), indicate that Yarkovsky drift is inversely proportional to diameter. Although the amount of absorbed radiation increases with the square of the diameter, mass increases with the cube of the diameter ( $D$ ), so drift rate is expected to show a  $1/D$  dependence.

However, because thermal inertia could also depend on size, the size-dependence of Yarkovsky drift could be more complicated than presently assumed. Theory predicts that the more massive a body is, the more regolith it should retain (Scheeres et al. 2002), and regolith may act as an insulating blanket (though for bodies smaller than 10 km in diameter, spin state may be more indicative of regolith presence). Low porosity and high thermal inertia should create a longer time lag between absorbed radiation and thermal re-radiation, perhaps resulting in a stronger Yarkovsky effect (depending on the rotation state).

Additionally, these models incorporate physical properties of asteroids that are often poorly measured. Although obliquity, heat capacity, thermal conductivity, and bulk density are generally difficult to quantify, more basic properties such as geometric albedo ( $p_V$ ) and diameter can be ill-constrained. This dearth of information has hindered the accuracy of

Yarkovsky predictions.

The Wide-field Infrared Survey Explorer (WISE) (Wright et al. 2010) has observed over 150,000 minor planets (including  $\sim 600$  NEAS) at infrared wavelengths (Mainzer et al. 2011a). It is these infrared measurements, combined with optical observations, that can separate the contributions of size and  $p_V$  to the observed flux. The dependence of flux on  $p_V$  is weaker in the thermal wavelengths, since the majority of the light emitted from the asteroid is from thermal emission, not reflected infrared sunlight. With a thermal model that incorporates both infrared and optical observations, size and  $p_V$  can be determined. With thermally-dominated WISE wavelengths, it has been shown that for asteroids observed with good signal-to-noise ratios and relatively low amplitude lightcurve variations, diameter can be determined to within  $\pm 10\%$ , and  $p_V$  can be determined to within  $\pm 25\%$  of the amount of the albedo (Mainzer et al. 2011c,d). Combining WISE measurements with published reliable diameters determined from in situ spacecraft visits, stellar occultations, and radar produces a list of NEOs with well-determined diameters and geometric albedos.

## 2. Methods

We employed the mathematical formulation of the diurnal Yarkovsky effect developed by Vokrouhlický et al. (2000) to numerically estimate Yarkovsky drifts. Although our methods are not identical, this work follows that of Vokrouhlický et al. (2005), who predicted drifts for 28 NEAs. We expand from that foundation, incorporating newly available physical properties.

For a time step along an NEA’s orbit, the Yarkovsky acceleration was computed following equation (1) of Vokrouhlický et al. (2000). This equation assumes a spherical body and that temperatures throughout the body do not greatly deviate from an average

temperature. Obliquity was assumed to be  $0^\circ$  to produce maximum drift. Therefore, the reported drifts in this paper are upper limits. Additionally, a  $0^\circ$  obliquity assumes that all drift is due to the diurnal Yarkovsky effect, as the seasonal Yarkovsky effect has zero magnitude for this case (Bottke et al. 2006). This acceleration was resolved along orthogonal directions, and Gauss’ form of Lagrange’s planetary equations (Danby 1992) was employed to evaluate an orbit-averaged  $da/dt$ .

The magnitude of the diurnal Yarkovsky drift depends on physical parameters which can be ill-defined. The drift magnitude is not linearly related to these unknown parameters, and so the resultant drift magnitude was statistically modeled to more accurately determine the effect of these uncertainties. For each NEA, we used  $p_V$  and diameter measurements derived by WISE (Mainzer et al. 2011b) or other sources of reliable diameter and  $p_V$  measurements in the literature, primarily radar detections and stellar occultations. We employed a Monte Carlo method to explore how variations in physical parameters contribute to errors in the prediction of  $da/dt$ . For 1000 realizations per NEA, we added Gaussian-distributed noise to the diameter and  $p_V$  measurements, so that standard distribution of the noise corresponded to the  $1\sigma$  error bars on those measurements.

As the formulation of Vokrouhlický et al. (2000) relies on Bond albedo  $A$ , we approximated  $A$  using  $A \approx (0.290 + 0.684G)p_V$ , where  $G$  is the slope parameter (Bowell et al. 1989). In seven cases,  $G$  was available in the JPL Small-Bodies database (Chamberlin 2008). In the remaining cases,  $G$  was taken to equal 0.15, as this was the value used to compute physical properties of NEAs in Mainzer et al. (2011a), based on the standard value assumed by the Minor Planet Center for computing  $H$ .

Additionally, we varied the thermal conductivity, bulk density, and density of the surface layer between the ranges shown in Table 1. The physical parameters in Table 1 were chosen to represent a range of asteroid compositions, so that our Yarkovsky estimates

would represent reasonable estimates of the range of physical properties of rocky asteroids. At one end of the spectrum are physical parameters mimicking a low-density rubble pile, at the other, a regolith-free rock chunk.

Emissivity was always assumed to be 0.9. If rotation rate was not available in the JPL Database (Chamberlin 2008), the rotation rate was assumed to be 5 revolutions/day, based on the average spin rate values for asteroids 1 to 10 km in diameter shown in Figure 1 of Pravec & Harris (2000). Rotation rates were unavailable for 81% of the NEAs.

The  $da/dt$  values quoted in this paper are the mean of these 1000 realizations. Error bars on  $da/dt$  were determined by computing the standard deviation from the mean.

Table 1: Physical and thermal properties used for generating predictions of  $da/dt$  drifts. Thermal properties are based on the work of Opeil et al. (2010), who measured three meteorites at 200 K. Listed are heat capacity  $C$ , thermal conductivity  $K$ , bulk density of the surface  $\rho_s$ , and mean bulk density  $\rho_b$ . The surface and bulk densities are assumed to have a similar range of values, however,  $\rho_s$  was not necessarily equal to  $\rho_b$  for a given object and realization.

Composition	$C$ (J kg <sup>-1</sup> K <sup>-1</sup> )	$K$ (W m <sup>-1</sup> K <sup>-1</sup> )	$\rho_s/\rho_b$ (kg m <sup>-3</sup> )
Rubble Pile	500	0.01	1000
Rock Chunk	500	0.50	3000

### 3. Results

We estimated diurnal Yarkovsky drifts for 540 NEAs with measured diameters and geometric albedos. The dozen objects with the highest drifts are listed in Table 2, upcoming apparitions of those objects are in Table 3, and predicted drifts for all objects are in

Table 4. Tables 2 and 4 include an order of magnitude estimate of along-track displacement ( $\Delta\rho$ ) that would result from the  $da/dt$  drift over 10 years. For this we use the following formulation from Vokrouhlický et al. (2000),

$$\Delta\rho \simeq 7\dot{a}_4(\Delta_{10}t)^2a_{AU}^{-3/2} \quad (1)$$

where  $\Delta\rho$  is in units of km,  $\dot{a}_4$  is  $da/dt$  in units of  $10^{-4}$  AU/Myr,  $\Delta_{10}t$  is the time difference between observations in tens of years, and  $a_{AU}$  is the semimajor axis of the object in AU. We note that the four of the twelve objects with the largest predicted drifts were discovered by the NEOWISE portion of the WISE mission (2010 JG87, 2010 HX107, 2010 EX11, and 2010 GQ75).

Individual realizations for the NEA with the fastest predicted drift, 2010 JG87, are examined in Figures 1 and 2. In each of these figures, all 1000 realizations of physical parameter combinations are shown, so their individual influences are apparent for this object.

2010 JG87’s diameter was determined to within  $\pm 10\%$  (Mainzer et al. 2011b) based on the WISE observations (Figure 1), and as diameter and bulk density are used to estimate mass, it is the uncertainty in bulk density that mainly determines the predicted drift for this object (Figure 2). Surface density and thermal conductivity both contribute to the thermal lag, and for this object, low values of  $K$  and  $\rho_s$  lead to a thermal lag that produces the strongest drifts (given the object’s assumed rotation period of 5 revolutions/day). As geometric albedo has been determined to be  $0.20 \pm 0.04$  for this object, the range of geometric albedo values explored do not strongly influence the resulting drift.

We now examine the values that govern Yarkovsky strength for all objects in our sample. As we are comparing the mean  $da/dt$  values of each object, the following compares drifts effectively computed with the same bulk density and density of the surface layer. The predicted diurnal  $da/dt$  has a  $1/D$  dependence, and also depends on the amount of average



incident radiation the NEA receives per orbit and  $da/dt$ .

The  $1/D$  dependence can be seen in Figure 3. As all objects in these plots are assumed to have the same bulk density ( $2000 \text{ kg m}^{-3}$ ), it is only the difference in diameters that produces different mass estimates.

After diameter, the second parameter that strongly influences drift magnitude is the average incident radiation per orbit, as seen in Figure 3. The more light received by the NEA over its orbit, the more light is available for re-emission and the loss of momentum that powers the drift.

Many values of  $da/dt$  reported in Table 4 have large error bars due to uncertainties in physical properties. Observations that further constrain the obliquity, density, rotation rate, thermal conductivity and heat capacity would also constrain predicted drift rates. Measurements of thermal properties of these objects would be valuable, as would the measurement of rotation rates and obliquities (either from lightcurves or radar observations). It’s expected that 1/6 objects larger than 200 meters are binary systems (Margot et al. 2002; Pravec et al. 2006), a property which could enable density measurements.

Historically, Yarkovsky detections require either radar observations over three apparitions (Chesley et al. 2003) or optical observations that meet a set of criteria. Nugent et al. (2012) required an object to (1) have an observed arc of at least  $\sim 15$  years, (2) have observations distributed throughout that arc in time (defined as at least 8 observations per orbit for at least 5 orbits) and (3) have a fraction of these observations at favorable geometries and distances (defined by the Yarkovsky sensitivity  $s_Y > 2.0$ ).

None of the objects in Table 2 have enough optical or radar observations to meet the above criteria for detection. Therefore, when possible we encourage the community to observe these objects and contribute astrometry to the Minor Planet Center. More

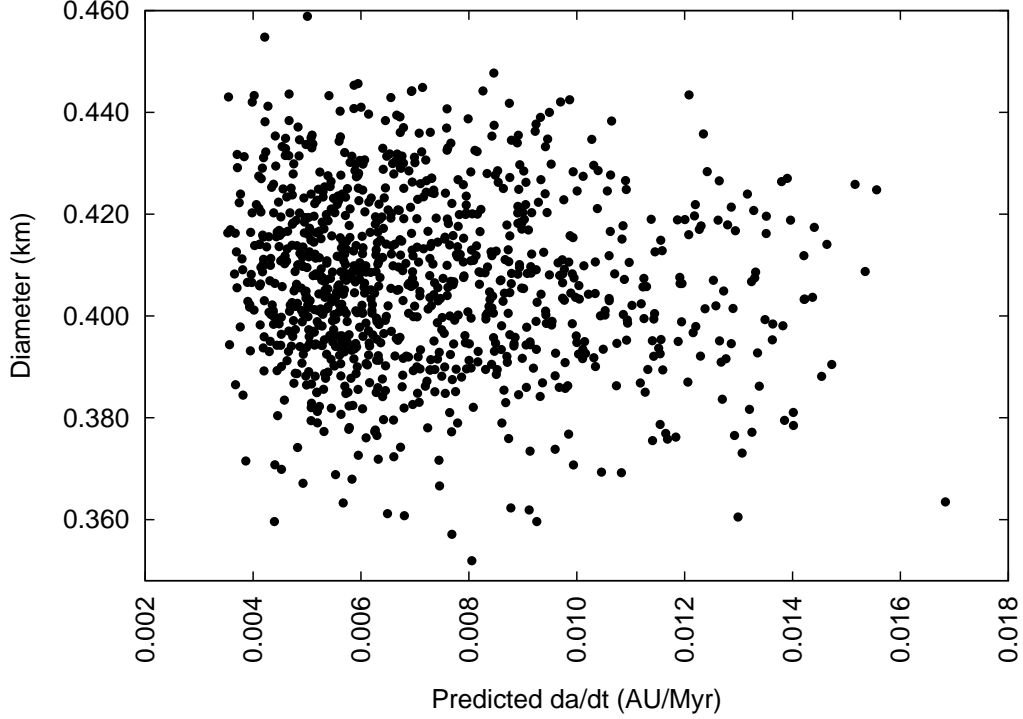


Fig. 1.— 1000 realizations of diameter vs  $da/dt$  for NEA 2010 JG87. Each point represents the drift produced by a different combination of physical parameters. This object has the fastest predicted diurnal drift of all the NEAs in this paper, with  $da/dt = (72.11 \pm 25.12) \times 10^{-4}$  AU/Myr. Although Yarkovsky drift has a  $1/D$  dependence, the relatively small error bars on this object’s diameter (and therefore the small range of diameters shown in this plot), combined with the variations in the other parameters (surface density, bulk density, thermal conductivity  $K$ ,  $p_v$ , and  $G$ ) prevent this dependence from being immediately apparent in this figure. For a clearer illustration of the relationship between  $da/dt$  and diameter, see Figure 3. For the relationship between  $da/dt$  and the other physical properties that were varied during each realization, see Figure 2.

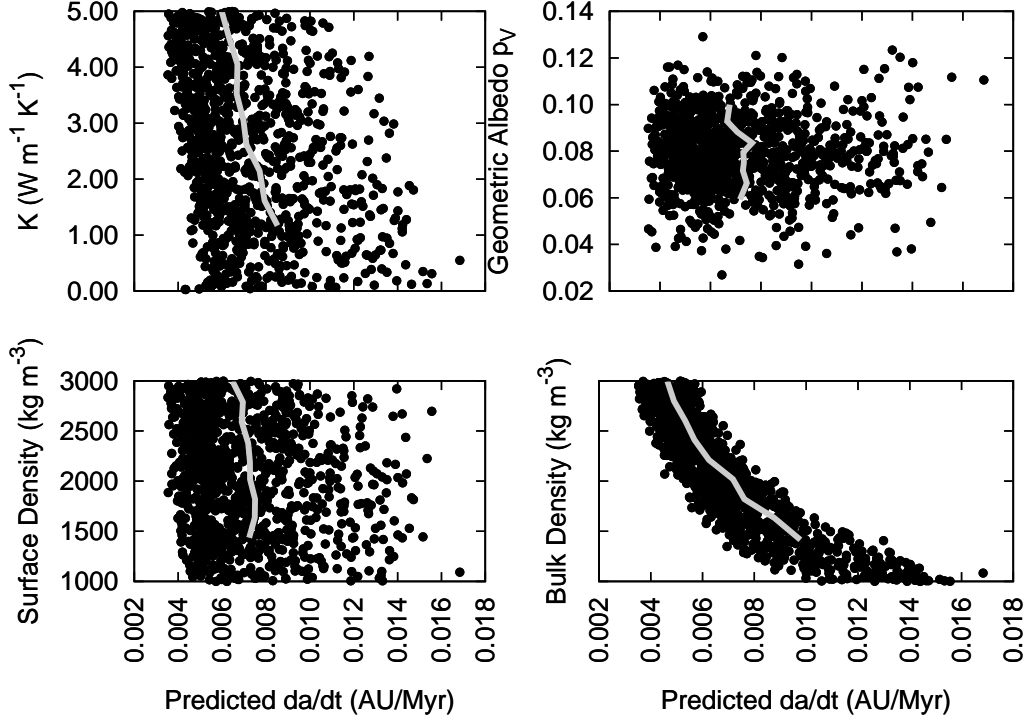


Fig. 2.— 1000 realizations of predicted diurnal  $da/dt$  drift for 2010 JG87, the NEA with the fastest predicted diurnal drift in this paper. For each realization, diameter, thermal conductivity, geometric albedo, slope parameter  $G$ , density of the surface layer, and bulk density were varied as described in the text. Grey lines are running averages. For this object, it is the uncertainty in bulk density that is mainly responsible for the span of calculated  $da/dt$  drifts, as the diameter of this object is well-constrained (see Figure 1). Also visible are the relationships between thermal conductivity and surface density and drift. These two properties govern the thermal lag angle.

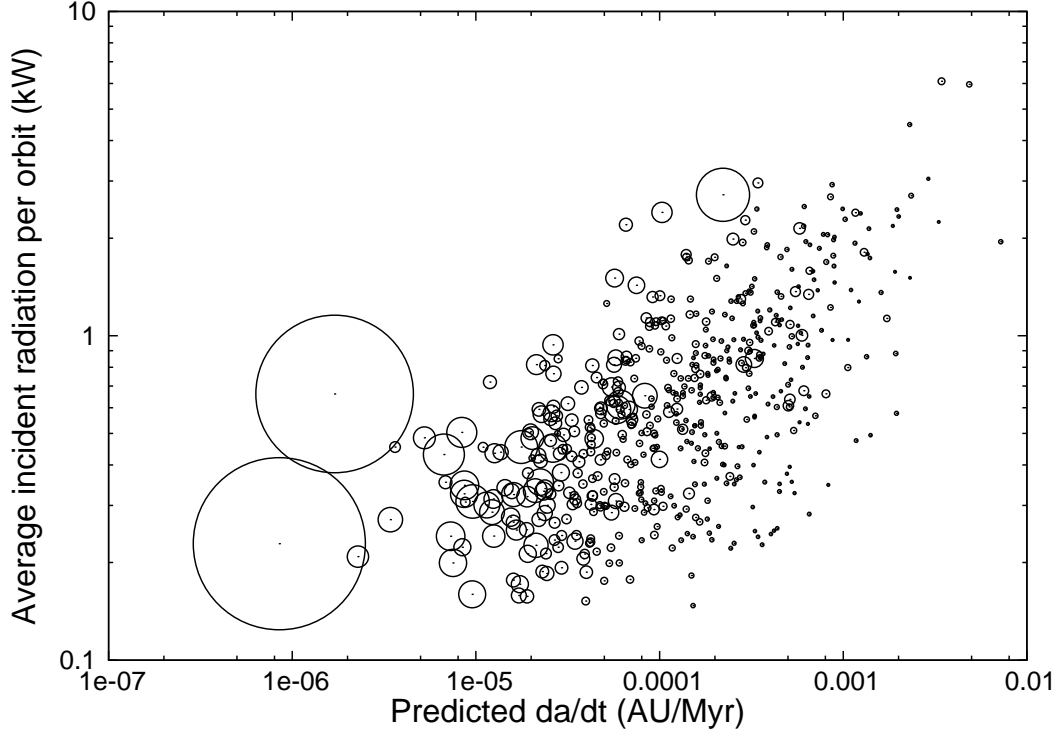


Fig. 3.— Relationship between the average incident radiation each NEA receives per orbit and predicted diurnal  $da/dt$  drift. Circle sizes are proportional to the diameter of the object. The more sunlight an object receives during its orbit, the more power is available to the Yarkovsky drift. However, this link is tempered by the the diameter— larger objects experience a smaller drift than smaller objects, given the same average incident radiation.

astrometry is needed for all these objects to enable a future Yarkovsky detection via a fit to optical-only data.

To facilitate these observations, Table 3 provides apparitions and associated apparent magnitude ranges for these objects between April 1st, 2012 and April 1st, 2022. These apparitions are defined as the times when the object’s elongation is greater than  $90^\circ$ , and were generated using the JPL’s Horizons ephemeris computation service.

The worldwide community of amateur and professional follow up observers is encouraged to consult this table when planning their observations. Several of the brighter objects may also be automatically picked up by sky surveys such as (in order of decreasing number of observations) PanSTARRS, the Catalina Sky Survey, Spacewatch, and the Lincoln Near Earth Asteroid Research Program (Larson 2007; McMillan 2007; Stokes et al. 2000). However, some of these objects only have brief windows where their elongation is greater than  $90^\circ$  and  $V < 20.5$  mag (which is roughly the sensitivity limit of most surveys) and may be missed without special attention. The two brightest objects are likely to be automatically observed by surveys, however, additional observations that expanded coverage over the orbit in mean anomaly would be useful.

Unfortunately, not all objects are easily observable. 2010 EX11 does not have an elongation greater than  $90^\circ$  during that time span, though on two apparitions (in 2012 and 2013) it does exceed  $60^\circ$ . Several of the remaining objects are extremely faint, with  $V$  (mag) rarely brighter than 23.5. Although these observations may be challenging, they are vital for well-defined orbits and future Yarkovsky detections.

#### 4. Conclusion

In this paper we use WISE-derived geometric albedos and diameters, as well as values for geometric albedos and diameters published in the literature, to produce more accurate diurnal Yarkovsky drift predictions for 540 NEAs. Table 2 lists the 12 objects in our sample with the fastest rates, and Table 3 gives their apparitions over the next decade. Three of these objects have observed arcs of less than a year, and we encourage observers to obtain more astrometry of these objects when possible. Predicting which NEAs are most likely to be subject to strong Yarkovsky drifts relies upon robust determinations of asteroid physical properties, underscoring the need to continue to obtain such characterization data.

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<sup>E1</sup>NOTE TO EDITOR: Table 4 should appear in online supplementary material.

Table 2. The 12 NEAs with largest predicted Yarkovsky drift rates.

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2010 JG87	2.76	0.95	16.91	$0.41 \pm 0.02$	$0.20 \pm 0.04$	54 days	$72.11 \pm 25.12$	110.0
2006 HY51	2.60	0.97	30.58	$1.22 \pm 0.27$	$0.16 \pm 0.09$	2006-2011	$54.35 \pm 23.85$	90.8
2007 EP88	0.84	0.89	20.78	$0.64 \pm 0.04$	$0.17 \pm 0.04$	2007-2010	$48.57 \pm 16.22$	443.8
(137924) 2000 BD19	0.88	0.89	25.69	$0.97 \pm 0.04$	$0.25 \pm 0.05$	1997-2010	$34.30 \pm 12.02$	292.6
2010 HX107	0.80	0.30	3.37	$0.06 \pm 0.01$	$0.19 \pm 0.07$	60 days	$33.11 \pm 23.05$	323.6
2002 LT24	0.72	0.50	0.76	$0.14 \pm 0.02$	$0.14 \pm 0.07$	2002-2010	$29.06 \pm 16.58$	333.1
(153201) 2000 WO107	0.91	0.78	7.78	$0.51 \pm 0.08$	$0.13 \pm 0.06$	2000-2010	$23.45 \pm 10.14$	188.7
2010 EX11	0.96	0.11	9.75	$0.04 \pm 0.01$	$0.23 \pm 0.09$	37 days	$23.09 \pm 18.64$	173.0
2008 EY5	0.63	0.63	5.07	$0.36 \pm 0.01$	$0.12 \pm 0.03$	2008-2011	$23.00 \pm 9.75$	324.6
2006 NL	0.85	0.58	20.08	$0.22 \pm 0.05$	$0.46 \pm 0.14$	2006-2009	$20.05 \pm 12.66$	179.8
2006 MD12	0.84	0.61	27.27	$0.27 \pm 0.06$	$0.43 \pm 0.13$	2006-2009	$19.60 \pm 12.15$	178.6
2010 GQ75	2.43	0.87	43.23	$0.37 \pm 0.02$	$0.11 \pm 0.03$	34 days	$19.48 \pm 9.83$	36.0

Table 3. Observing opportunities for NEAs with highest predicted Yarkovsky drift rates. Apparitions listed are when elongation is greater than  $90^\circ$ . Apparitions with magnitude ranges always above 23.5  $V(\text{mag})$  are not shown.

NEA	$da/dt$ $10^{-4}$ AU/Myr	Apparition	$V$ (mag) range	Dec range degrees
2010 JG87	$64.99 \pm 23.26$	May 29 2014 - Sep 20 2014	20.3, 24.4	07, 19
2006 HY51	$34.32 \pm 14.86$	Feb 08 2014 - Jul 06 2014	21.5, 23.6	-12, -03
		Feb 04 2015 - Jun 17 2015	20.4, 22.9	06, 22
		Feb 05 2018 - Jul 08 2018	22.3, 24.0	-10, -02
		Mar 11 2019 - Jun 05 2019	17.9, 21.8	24, 53
		Jan 25 2020 - Jul 01 2020	23.4, 24.6	00, 08
		Feb 03 2022 - Apr 01 2022	23.3, 24.3	-09, -06
2007 EP88	$31.04 \pm 12.04$	Mar 14 2013 - May 14 2013	17.2, 21.2	-58, -03
		Feb 09 2014 - May 26 2014	19.7, 21.1	-44, -14
		Mar 11 2015 - Mar 25 2015	19.9, 20.6	-59, -51
		Feb 10 2017 - May 26 2017	19.5, 21.2	-42, -11
		Feb 19 2018 - Apr 27 2018	18.8, 21.3	-79, -40
		Feb 17 2020 - May 24 2020	19.0, 21.4	-43, -09
		Feb 13 2021 - May 14 2021	19.2, 21.4	-56, -27
(137924) 2000 BD19	$34.30 \pm 12.02$	Dec 15 2012 - Mar 10 2013	17.8, 20.2	42, 76
		Nov 28 2013 - Mar 17 2014	18.5, 19.9	31, 53
		Dec 05 2014 - Feb 28 2015	16.6, 20.2	23, 54
		Jan 23 2017 - Feb 19 2017	18.2, 19.4	46, 54
		Dec 03 2017 - Mar 15 2018	18.4, 20.1	36, 61
		Nov 29 2018 - Mar 15 2019	18.1, 20.2	27, 50
		Dec 14 2019 - Feb 05 2020	15.7, 19.8	16, 22
		Dec 22 2021 - Mar 08 2022	17.6, 20.1	43, 85
2010 HX107	$69.83 \pm 30.39$	Apr 28 2015 - May 19 2015	22.7, 23.3	14, 26
2002 LT24	$57.95 \pm 20.60$	May 22 2013 - Jul 16 2013	16.6, 21.0	-10, -04
		Jun 10 2016 - Jul 13 2016	20.6, 22.1	-06, 08
(153201) 2000 WO107	$23.45 \pm 10.14$	Dec 15 2013 - Feb 06 2014	18.7, 21.8	-02, 20
		Nov 08 2014 - Feb 26 2015	18.9, 22.2	17, 31
		Nov 05 2015 - Mar 04 2016	19.7, 21.8	20, 34
		Nov 13 2016 - Feb 25 2017	18.9, 22.2	19, 44
		Dec 09 2017 - Jan 10 2018	19.9, 21.5	08, 13

Table 3—Continued

NEA	$da/dt$ $10^{-4}$ AU/Myr	Apparition	$V$ (mag) range	Dec range degrees
		Nov 29 2020 - Feb 14 2021	13.0, 22.1	13, 25
		Nov 05 2021 - Mar 01 2022	19.3, 22.1	19, 32
2010 EX11	$89.47 \pm 40.33$	(not observable)		
2008 EY5	$31.79 \pm 10.60$	Feb 25 2013 - Mar 23 2013	17.4, 19.1	-76, -46
		Feb 25 2014 - Mar 20 2014	17.6, 19.4	-85, -45
		Feb 27 2015 - Mar 17 2015	18.2, 19.5	-69, -43
		Mar 02 2016 - Mar 10 2016	19.1, 19.6	-51, -43
2006 NL	$20.05 \pm 12.66$	Jun 30 2013 - Oct 02 2013	16.7, 21.8	-42, 19
		Jul 15 2014 - Sep 05 2014	20.3, 21.8	-30, -08
		Jun 21 2017 - Oct 09 2017	19.5, 21.2	-60, -04
		Jul 07 2020 - Sep 27 2020	15.4, 21.8	-38, 62
		Jul 06 2021 - Sep 18 2021	19.9, 21.8	-54, -08
2006 MD12	$19.60 \pm 12.15$	May 22 2012 - Aug 30 2012	18.6, 21.3	-61, -15
		Jun 12 2015 - Aug 20 2015	19.4, 21.5	-61, -24
		May 25 2016 - Aug 15 2016	18.3, 21.5	-15, 55
		May 18 2019 - Aug 31 2019	17.8, 21.2	-28, 02
2010 GQ75	$36.30 \pm 12.49$	Apr 14 2013 - Sep 02 2013	23.3, 25.7	-53, -32
		Apr 30 2017 - Jul 25 2017	21.5, 24.5	-70, -36

Table 4. NEAs with highest predicted Yarkovsky drift rates

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2010 JG87	2.76	0.95	16.91	$0.41 \pm 0.02$	$0.20 \pm 0.04$	54 days	$72.11 \pm 25.12$	110.0
2006 HY51	2.60	0.97	30.58	$1.22 \pm 0.27$	$0.16 \pm 0.09$	2006-2011	$54.35 \pm 23.85$	90.8
2007 EP88	0.84	0.89	20.78	$0.64 \pm 0.04$	$0.17 \pm 0.04$	2007-2010	$48.57 \pm 16.22$	443.8
(137924) 2000 BD19	0.88	0.89	25.69	$0.97 \pm 0.04$	$0.25 \pm 0.05$	1997-2010	$34.30 \pm 12.02$	292.6
2010 HX107	0.80	0.30	3.37	$0.06 \pm 0.01$	$0.19 \pm 0.07$	60 days	$33.11 \pm 23.05$	323.6
2002 LT24	0.72	0.50	0.76	$0.14 \pm 0.02$	$0.14 \pm 0.07$	2002-2010	$29.06 \pm 16.58$	333.1
(153201) 2000 WO107	0.91	0.78	7.78	$0.51 \pm 0.08$	$0.13 \pm 0.06$	2000-2010	$23.45 \pm 10.14$	188.7
2010 EX11	0.96	0.11	9.75	$0.04 \pm 0.01$	$0.23 \pm 0.09$	37 days	$23.09 \pm 18.64$	173.0
2008 EY5	0.63	0.63	5.07	$0.36 \pm 0.01$	$0.12 \pm 0.03$	2008-2011	$23.00 \pm 9.75$	324.6
2006 NL	0.85	0.58	20.08	$0.22 \pm 0.05$	$0.46 \pm 0.14$	2006-2009	$20.05 \pm 12.66$	179.8
2006 MD12	0.84	0.61	27.27	$0.27 \pm 0.06$	$0.43 \pm 0.13$	2006-2009	$19.60 \pm 12.15$	178.6
2010 GQ75	2.43	0.87	43.23	$0.37 \pm 0.02$	$0.11 \pm 0.03$	34 days	$19.48 \pm 9.83$	36.0
2010 GR7	1.83	0.85	24.22	$0.45 \pm 0.01$	$0.38 \pm 0.07$	2010-2011	$19.33 \pm 9.42$	54.6
2001 CQ36	0.94	0.18	1.29	$0.07 \pm 0.01$	$0.41 \pm 0.11$	2001-2011	$19.13 \pm 13.63$	146.9
2010 AJ30	0.81	0.30	7.59	$0.11 \pm 0.02$	$0.12 \pm 0.06$	37 days	$18.61 \pm 12.30$	178.1
2004 LG	2.07	0.90	70.97	$0.87 \pm 0.01$	$0.15 \pm 0.03$	2004-2010	$17.26 \pm 7.47$	40.7
2010 HW81	1.22	0.73	12.85	$0.35 \pm 0.05$	$0.04 \pm 0.02$	10 days	$16.08 \pm 8.64$	83.8
2010 NB2	2.08	0.76	28.66	$0.21 \pm 0.01$	$0.30 \pm 0.05$	34 days	$14.09 \pm 9.16$	32.9
2010 NJ1	0.97	0.54	11.22	$0.22 \pm 0.04$	$0.26 \pm 0.10$	2010-2011	$13.97 \pm 8.77$	102.6
(252399) 2001 TX44	0.87	0.55	15.21	$0.26 \pm 0.05$	$0.68 \pm 0.20$	2001-2010	$13.81 \pm 9.00$	118.2
2010 GA7	0.91	0.39	30.02	$0.15 \pm 0.02$	$0.26 \pm 0.12$	54 days	$13.57 \pm 9.25$	108.9
(162195) 1999 RK45	1.60	0.77	5.89	$0.39 \pm 0.08$	$0.19 \pm 0.06$	1999-2011	$13.39 \pm 8.38$	46.4
(139289) 2001 KR1	1.26	0.84	23.23	$1.13 \pm 0.24$	$0.13 \pm 0.07$	2001-2010	$12.98 \pm 7.36$	64.3
2005 GB120	0.79	0.39	9.15	$0.21 \pm 0.01$	$0.28 \pm 0.04$	2005-2010	$12.44 \pm 7.53$	123.7
2006 SY5	1.04	0.15	7.56	$0.09 \pm 0.02$	$0.34 \pm 0.23$	2006-2007	$12.19 \pm 9.89$	80.1
2010 NU1	2.12	0.78	33.70	$0.29 \pm 0.05$	$0.07 \pm 0.03$	8 days	$11.76 \pm 7.57$	26.7
2005 MB	0.99	0.79	41.40	$1.01 \pm 0.14$	$0.25 \pm 0.10$	2003-2011	$11.66 \pm 5.05$	83.5
(234341) 2001 FZ57	0.94	0.60	20.67	$0.34 \pm 0.05$	$0.49 \pm 0.19$	2000-2011	$11.58 \pm 6.71$	88.4
2010 LJ61	1.04	0.46	9.73	$0.19 \pm 0.03$	$0.21 \pm 0.08$	10 days	$11.02 \pm 8.22$	72.6
(225312) 1996 XB27	1.19	0.06	2.47	$0.08 \pm 0.02$	$0.48 \pm 0.26$	1996-2009	$10.63 \pm 8.81$	57.4

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2008 EM9	1.96	0.85	9.40	$0.79 \pm 0.03$	$0.32 \pm 0.07$	2008-2011	$10.60 \pm 5.22$	27.0
(66400) 1999 LT7	0.86	0.57	9.07	$0.41 \pm 0.08$	$0.18 \pm 0.09$	1999-2010	$10.25 \pm 5.93$	90.7
2008 CN1	0.77	0.35	7.22	$0.23 \pm 0.00$	$0.20 \pm 0.03$	2008-2010	$9.93 \pm 6.71$	102.8
(164202) 2004 EW	0.99	0.28	4.66	$0.16 \pm 0.03$	$0.36 \pm 0.22$	2004-2011	$8.97 \pm 6.47$	63.9
2010 NG1	0.85	0.33	24.74	$0.23 \pm 0.04$	$0.23 \pm 0.11$	71 days	$8.96 \pm 6.03$	80.1
(141531) 2002 GB	0.99	0.53	22.56	$0.30 \pm 0.01$	$0.48 \pm 0.08$	2002-2012	$8.91 \pm 5.37$	63.1
2009 JO2	0.89	0.48	19.63	$0.31 \pm 0.03$	$0.34 \pm 0.09$	2009-2011	$8.85 \pm 5.55$	74.0
(255071) 2005 UH6	1.00	0.63	2.64	$0.52 \pm 0.14$	$0.22 \pm 0.07$	2005-2011	$8.83 \pm 6.11$	61.7
2010 FA81	1.20	0.15	15.48	$0.10 \pm 0.02$	$0.22 \pm 0.09$	48 days	$8.75 \pm 7.80$	46.9
(33342) 1998 WT24	0.72	0.42	7.34	$0.42 \pm 0.04$	$0.56 \pm 0.20$	1998-2008	$8.70 \pm 4.93$	100.0
1998 SV4	0.82	0.64	53.30	$0.74 \pm 0.15$	$0.20 \pm 0.06$	1998-2010	$8.53 \pm 4.40$	80.9
(163758) 2003 OS13	1.30	0.74	41.56	$0.66 \pm 0.13$	$0.44 \pm 0.14$	2003-2009	$8.52 \pm 5.15$	40.4
2010 LH14	2.20	0.57	4.66	$0.10 \pm 0.02$	$0.27 \pm 0.11$	152 days	$8.30 \pm 7.22$	17.8
(307918) 2004 EU9	0.88	0.51	28.59	$0.37 \pm 0.05$	$0.36 \pm 0.10$	2004-2010	$8.22 \pm 5.21$	69.7
(267221) 2001 AD2	1.04	0.66	1.66	$0.56 \pm 0.02$	$0.10 \pm 0.02$	2001-2011	$8.08 \pm 4.37$	53.4
2006 KZ112	2.52	0.89	37.76	$1.18 \pm 0.03$	$0.27 \pm 0.05$	2006-2010	$8.06 \pm 3.89$	14.1
2003 HB	0.85	0.38	18.11	$0.29 \pm 0.05$	$0.27 \pm 0.10$	2003-2010	$7.79 \pm 5.01$	69.6
2010 GW62	1.27	0.58	32.43	$0.28 \pm 0.02$	$0.38 \pm 0.08$	72 days	$7.62 \pm 5.19$	37.3
2010 JE87	0.91	0.44	17.15	$0.31 \pm 0.02$	$0.11 \pm 0.03$	5 days	$7.42 \pm 4.82$	60.1
(164207) 2004 GU9	1.00	0.14	13.65	$0.16 \pm 0.01$	$0.22 \pm 0.04$	2001-2011	$7.26 \pm 6.21$	50.8
(275974) 2001 XD	2.04	0.80	11.41	$0.63 \pm 0.10$	$0.22 \pm 0.10$	2001-2010	$7.06 \pm 4.41$	16.9
2010 NY65	1.00	0.37	11.72	$0.23 \pm 0.01$	$0.07 \pm 0.01$	27 days	$6.93 \pm 4.75$	48.9
2010 LK68	1.16	0.47	21.76	$0.24 \pm 0.02$	$0.03 \pm 0.01$	4 days	$6.86 \pm 4.57$	38.3
(141432) 2002 CQ11	0.98	0.43	2.46	$0.24 \pm 0.04$	$0.34 \pm 0.14$	2002-2011	$6.83 \pm 5.12$	49.4
2009 WZ104	0.86	0.19	9.84	$0.24 \pm 0.00$	$0.31 \pm 0.07$	2005-2010	$6.59 \pm 4.72$	58.3
(162269) 1999 VO6	1.14	0.74	40.10	$1.01 \pm 0.18$	$0.27 \pm 0.11$	1993-2011	$6.56 \pm 3.69$	37.9
2010 DK34	2.75	0.76	27.47	$0.28 \pm 0.01$	$0.15 \pm 0.03$	32 days	$6.53 \pm 4.84$	10.0
(41429) 2000 GE2	1.59	0.55	2.19	$0.20 \pm 0.03$	$0.27 \pm 0.08$	1998-2010	$6.53 \pm 5.07$	22.7
(225416) 1999 YC	1.42	0.83	38.22	$1.65 \pm 0.18$	$0.09 \pm 0.03$	1999-2010	$6.48 \pm 2.77$	26.8
(67381) 2000 OL8	1.32	0.54	10.67	$0.28 \pm 0.06$	$0.25 \pm 0.08$	2000-2011	$6.43 \pm 4.96$	29.7



Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2010 KU7	1.66	0.38	6.76	$0.10 \pm 0.01$	$0.22 \pm 0.08$	40 days	$6.42 \pm 5.06$	20.9
(152564) 1992 HF	1.39	0.56	13.31	$0.28 \pm 0.05$	$0.17 \pm 0.07$	1992-2010	$6.40 \pm 4.77$	27.3
2006 DS14	0.86	0.34	26.53	$0.32 \pm 0.01$	$0.12 \pm 0.02$	2002-2010	$6.26 \pm 4.00$	54.6
2010 GR75	1.73	0.64	17.78	$0.28 \pm 0.05$	$0.33 \pm 0.09$	84 days	$6.23 \pm 4.47$	19.2
(242191) 2003 NZ6	0.79	0.49	18.24	$0.37 \pm 0.03$	$0.33 \pm 0.07$	2003-2010	$6.13 \pm 4.07$	60.7
2002 WZ2	2.46	0.88	51.40	$1.60 \pm 0.12$	$0.11 \pm 0.03$	2002-2010	$6.10 \pm 3.12$	11.1
(230111) 2001 BE10	0.82	0.37	17.51	$0.40 \pm 0.06$	$0.25 \pm 0.06$	2001-2010	$6.09 \pm 4.26$	57.0
2005 WC1	1.40	0.49	19.98	$0.29 \pm 0.06$	$0.11 \pm 0.03$	2005-2011	$6.00 \pm 4.25$	25.3
(242643) 2005 NZ6	1.83	0.86	8.50	$1.99 \pm 0.48$	$0.04 \pm 0.04$	2005-2010	$5.95 \pm 3.48$	16.8
2010 JG	1.19	0.32	23.31	$0.19 \pm 0.03$	$0.21 \pm 0.08$	2010-2011	$5.88 \pm 4.90$	31.7
(184990) 2006 KE89	1.05	0.80	45.08	$1.96 \pm 0.11$	$0.13 \pm 0.03$	1994-2012	$5.79 \pm 2.53$	37.5
2010 FG81	1.66	0.39	7.97	$0.11 \pm 0.00$	$0.07 \pm 0.01$	36 days	$5.78 \pm 4.45$	18.9
2010 KX7	0.99	0.17	21.48	$0.21 \pm 0.02$	$0.08 \pm 0.02$	2010-2011	$5.71 \pm 4.57$	40.6
2009 WA	1.14	0.14	29.84	$0.16 \pm 0.03$	$0.22 \pm 0.14$	174 days	$5.68 \pm 4.51$	32.8
2010 OC101	1.22	0.23	13.60	$0.15 \pm 0.00$	$0.38 \pm 0.07$	182 days	$5.66 \pm 3.95$	29.4
(40267) 1999 GJ4	1.34	0.81	34.53	$1.64 \pm 0.05$	$0.45 \pm 0.09$	1955-2009	$5.49 \pm 2.49$	24.8
2010 HZ104	2.25	0.57	20.22	$0.14 \pm 0.02$	$0.09 \pm 0.06$	23 days	$5.43 \pm 4.51$	11.2
2010 LU108	2.24	0.82	9.51	$0.82 \pm 0.01$	$0.03 \pm 0.01$	51 days	$5.37 \pm 3.11$	11.2
2010 OF101	0.95	0.33	23.37	$0.30 \pm 0.05$	$0.23 \pm 0.12$	2010-2011	$5.26 \pm 3.69$	39.7
2010 HC	2.13	0.52	6.88	$0.13 \pm 0.01$	$0.33 \pm 0.06$	114 days	$5.25 \pm 4.50$	11.8
(285339) 1999 JR6	1.37	0.68	20.34	$0.61 \pm 0.02$	$0.27 \pm 0.06$	1999-2011	$5.25 \pm 3.27$	23.0
2003 CR1	1.45	0.46	12.71	$0.20 \pm 0.03$	$0.43 \pm 0.15$	2003-2010	$5.20 \pm 3.53$	20.8
(192559) 1998 VO	1.07	0.23	10.06	$0.22 \pm 0.04$	$0.30 \pm 0.17$	1998-2008	$5.15 \pm 4.43$	32.4
(194268) 2001 UY4	1.45	0.79	5.43	$1.24 \pm 0.02$	$0.05 \pm 0.01$	2001-2011	$5.13 \pm 2.54$	20.5
2010 KY127	2.50	0.88	60.38	$1.77 \pm 0.29$	$0.13 \pm 0.06$	2010-2011	$5.12 \pm 2.56$	9.1
2010 CJ171	2.00	0.49	7.38	$0.13 \pm 0.00$	$0.36 \pm 0.07$	174 days	$5.12 \pm 4.50$	12.7
(277570) 2005 YP180	1.37	0.62	4.11	$0.44 \pm 0.05$	$0.18 \pm 0.04$	2005-2011	$5.09 \pm 3.37$	22.2
2002 GO5	1.90	0.77	13.81	$0.75 \pm 0.15$	$0.24 \pm 0.08$	2002-2004	$5.08 \pm 3.37$	13.6
2005 YY93	2.58	0.88	23.43	$1.75 \pm 0.06$	$0.08 \pm 0.02$	2005-2010	$5.03 \pm 2.47$	8.5
2010 OS22	1.64	0.69	9.36	$0.50 \pm 0.01$	$0.41 \pm 0.09$	2010-2011	$5.01 \pm 3.02$	16.8

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(250680) 2005 QC5	0.89	0.36	9.45	$0.40 \pm 0.01$	$0.15 \pm 0.03$	1978-2011	$4.94 \pm 3.33$	41.0
2010 LL68	2.07	0.53	10.49	$0.15 \pm 0.02$	$0.06 \pm 0.02$	124 days	$4.93 \pm 4.16$	11.6
2010 PM58	1.37	0.46	13.60	$0.26 \pm 0.04$	$0.10 \pm 0.04$	181 days	$4.80 \pm 3.76$	20.9
2007 VD12	1.15	0.36	22.86	$0.22 \pm 0.04$	$0.39 \pm 0.12$	19 days	$4.63 \pm 3.40$	26.4
1999 GY5	1.15	0.61	24.44	$0.67 \pm 0.12$	$0.04 \pm 0.02$	1999-2010	$4.59 \pm 2.90$	26.2
2010 PU66	1.49	0.39	18.09	$0.18 \pm 0.01$	$0.08 \pm 0.02$	62 days	$4.58 \pm 3.87$	17.7
(312070) 2007 TA19	0.95	0.51	22.63	$0.60 \pm 0.10$	$0.09 \pm 0.04$	2007-2011	$4.55 \pm 2.82$	34.2
2010 CB55	1.13	0.15	25.92	$0.20 \pm 0.00$	$0.04 \pm 0.01$	189 days	$4.51 \pm 3.42$	26.2
2010 JK33	2.23	0.61	4.03	$0.21 \pm 0.01$	$0.15 \pm 0.03$	2010-2010	$4.50 \pm 3.63$	9.5
2010 GO33	2.41	0.70	19.12	$0.31 \pm 0.02$	$0.38 \pm 0.09$	2010-2010	$4.49 \pm 3.55$	8.4
(152754) 1999 GS6	1.19	0.50	2.02	$0.41 \pm 0.08$	$0.22 \pm 0.11$	1999-2010	$4.43 \pm 3.37$	23.9
(4034) Vishnu	1.06	0.44	11.17	$0.42 \pm 0.07$	$0.58 \pm 0.25$	1986-2009	$4.37 \pm 3.00$	28.1
2010 GT7	2.71	0.68	9.28	$0.22 \pm 0.01$	$0.33 \pm 0.06$	75 days	$4.37 \pm 2.95$	6.8
2010 FL	1.91	0.66	11.45	$0.35 \pm 0.01$	$0.27 \pm 0.05$	2002-2010	$4.37 \pm 3.20$	11.5
2002 LS32	1.78	0.70	8.83	$0.57 \pm 0.12$	$0.29 \pm 0.09$	2002-2010	$4.35 \pm 3.58$	12.8
(152671) 1998 HL3	1.13	0.37	2.68	$0.30 \pm 0.01$	$0.20 \pm 0.04$	1998-2012	$4.31 \pm 3.22$	25.2
2007 BM8	1.34	0.72	27.63	$1.08 \pm 0.17$	$0.07 \pm 0.02$	2002-2010	$4.26 \pm 2.52$	19.2
2010 FH81	1.23	0.21	16.79	$0.20 \pm 0.01$	$0.09 \pm 0.02$	107 days	$4.21 \pm 3.43$	21.7
2010 OE22	2.65	0.63	14.31	$0.17 \pm 0.01$	$0.18 \pm 0.04$	61 days	$4.20 \pm 3.17$	6.8
2010 CC55	1.55	0.47	6.79	$0.24 \pm 0.01$	$0.03 \pm 0.01$	2010-2011	$4.15 \pm 3.08$	15.1
2010 GS7	2.71	0.65	9.68	$0.20 \pm 0.01$	$0.11 \pm 0.03$	154 days	$4.04 \pm 3.15$	6.3
2010 LM14	1.11	0.38	25.92	$0.36 \pm 0.08$	$0.04 \pm 0.01$	2010-2011	$3.98 \pm 3.18$	23.8
2010 GF25	1.40	0.73	37.57	$1.13 \pm 0.10$	$0.02 \pm 0.01$	8 days	$3.93 \pm 2.22$	16.7
2010 OB101	1.62	0.52	9.12	$0.28 \pm 0.02$	$0.14 \pm 0.03$	2010-2011	$3.90 \pm 2.98$	13.3
2010 LE15	0.86	0.27	13.26	$0.46 \pm 0.01$	$0.15 \pm 0.02$	2001-2010	$3.86 \pm 2.72$	33.6
2010 LJ68	1.69	0.43	16.50	$0.19 \pm 0.04$	$0.04 \pm 0.02$	7 days	$3.85 \pm 2.86$	12.3
(152637) 1997 NC1	0.87	0.21	16.72	$0.43 \pm 0.10$	$0.59 \pm 0.20$	1997-2009	$3.83 \pm 2.90$	33.3
2010 OL100	2.26	0.65	22.16	$0.31 \pm 0.04$	$0.25 \pm 0.06$	160 days	$3.74 \pm 2.86$	7.7
2002 EZ2	1.25	0.05	13.02	$0.21 \pm 0.04$	$0.40 \pm 0.12$	2002-2009	$3.67 \pm 3.72$	18.4
2010 GK23	2.92	0.70	35.38	$0.28 \pm 0.04$	$0.30 \pm 0.13$	8 days	$3.62 \pm 3.01$	5.1

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2005 OU2	1.23	0.37	47.77	$0.34 \pm 0.07$	$0.37 \pm 0.11$	2005-2009	$3.57 \pm 2.92$	18.2
(6239) Minos	1.15	0.41	3.95	$0.47 \pm 0.12$	$0.56 \pm 0.39$	1983-2009	$3.54 \pm 2.68$	20.0
2010 GP67	1.11	0.11	13.27	$0.25 \pm 0.02$	$0.03 \pm 0.01$	205 days	$3.53 \pm 2.71$	21.0
2009 XF2	1.29	0.25	14.01	$0.24 \pm 0.04$	$0.27 \pm 0.14$	202 days	$3.52 \pm 3.19$	16.9
2010 JD87	1.43	0.64	24.58	$0.69 \pm 0.01$	$0.09 \pm 0.02$	28 days	$3.50 \pm 2.23$	14.4
2010 OH126	1.90	0.50	14.39	$0.22 \pm 0.01$	$0.10 \pm 0.02$	15 days	$3.49 \pm 2.75$	9.3
(152941) 2000 FM10	1.48	0.68	8.74	$0.82 \pm 0.00$	$0.21 \pm 0.03$	2000-2012	$3.49 \pm 2.23$	13.5
(3361) Orpheus	1.21	0.32	2.69	$0.35 \pm 0.06$	$0.36 \pm 0.13$	1982-2009	$3.44 \pm 2.41$	18.1
2010 LV108	2.75	0.66	4.78	$0.23 \pm 0.01$	$0.03 \pm 0.00$	30 days	$3.44 \pm 2.64$	5.3
(163243) 2002 FB3	0.76	0.60	20.27	$1.62 \pm 0.01$	$0.19 \pm 0.03$	2002-2010	$3.43 \pm 1.68$	36.1
(228502) 2001 TE2	1.08	0.20	7.62	$0.30 \pm 0.05$	$0.19 \pm 0.06$	2000-2009	$3.42 \pm 2.72$	21.2
2003 TL4	0.78	0.38	12.15	$0.38 \pm 0.07$	$0.22 \pm 0.07$	2003-2009	$3.39 \pm 2.83$	34.6
2000 TJ1	1.16	0.08	39.54	$0.25 \pm 0.04$	$0.40 \pm 0.16$	2000-2010	$3.37 \pm 2.89$	18.9
2000 YF29	1.49	0.37	6.30	$0.24 \pm 0.04$	$0.25 \pm 0.15$	2000-2011	$3.34 \pm 2.66$	12.8
2010 OL101	2.61	0.60	26.07	$0.20 \pm 0.02$	$0.32 \pm 0.09$	132 days	$3.31 \pm 3.01$	5.5
2008 EV5	0.96	0.08	7.44	$0.40 \pm 0.01$	$0.14 \pm 0.01$	2008-2010	$3.29 \pm 2.57$	24.6
2010 ON101	1.63	0.41	9.31	$0.24 \pm 0.02$	$0.22 \pm 0.04$	2010-2012	$3.29 \pm 2.61$	11.1
2010 OD101	1.62	0.36	15.39	$0.20 \pm 0.03$	$0.22 \pm 0.07$	80 days	$3.29 \pm 2.48$	11.2
2004 SB20	1.18	0.41	30.28	$0.43 \pm 0.08$	$0.41 \pm 0.12$	2004-2008	$3.28 \pm 2.41$	17.9
(136874) 1998 FH74	2.20	0.88	21.26	$3.40 \pm 0.13$	$0.07 \pm 0.02$	1995-2011	$3.28 \pm 1.44$	7.0
2007 BG29	0.83	0.33	18.51	$0.65 \pm 0.02$	$0.26 \pm 0.05$	2007-2012	$3.26 \pm 2.22$	30.1
2007 YQ56	1.14	0.29	26.46	$0.34 \pm 0.07$	$0.16 \pm 0.05$	2007-2008	$3.26 \pm 2.55$	18.7
1996 GQ	1.99	0.50	0.89	$0.21 \pm 0.00$	$0.02 \pm 0.00$	1996-2010	$3.25 \pm 2.64$	8.1
(285179) 1996 TY11	1.23	0.54	13.93	$0.62 \pm 0.12$	$0.09 \pm 0.03$	1996-2011	$3.24 \pm 2.24$	16.7
2010 JN71	2.39	0.59	17.72	$0.21 \pm 0.00$	$0.11 \pm 0.02$	38 days	$3.22 \pm 2.29$	6.1
(85990) 1999 JV6	1.01	0.31	5.32	$0.45 \pm 0.03$	$0.10 \pm 0.02$	1999-2012	$3.18 \pm 2.33$	22.0
(138971) 2001 CB21	1.03	0.33	7.90	$0.58 \pm 0.11$	$0.24 \pm 0.12$	2001-2011	$3.13 \pm 2.48$	20.8
2010 CN141	1.52	0.40	23.81	$0.25 \pm 0.01$	$0.03 \pm 0.01$	50 days	$3.12 \pm 2.21$	11.7
2003 TJ2	1.32	0.47	17.44	$0.45 \pm 0.09$	$0.23 \pm 0.07$	2003-2012	$3.11 \pm 2.62$	14.4
2010 NZ1	1.37	0.65	32.79	$0.85 \pm 0.05$	$0.04 \pm 0.01$	1997-2010	$3.09 \pm 1.94$	13.5

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(277617) 2006 BT7	1.52	0.63	16.14	$0.67 \pm 0.10$	$0.19 \pm 0.08$	2006-2012	$3.08 \pm 1.94$	11.5
2010 CO1	1.01	0.22	23.97	$0.38 \pm 0.00$	$0.03 \pm 0.00$	15 days	$3.07 \pm 2.16$	21.1
2004 XK50	1.45	0.69	38.21	$1.04 \pm 0.08$	$0.04 \pm 0.01$	2004-2011	$3.05 \pm 1.83$	12.2
2010 JH87	1.54	0.54	43.77	$0.43 \pm 0.07$	$0.13 \pm 0.06$	2010-2011	$3.05 \pm 2.32$	11.2
2005 GY110	1.85	0.69	12.64	$0.66 \pm 0.02$	$0.19 \pm 0.03$	2005-2010	$2.98 \pm 1.84$	8.3
(154993) 2005 EA94	1.52	0.66	10.32	$0.83 \pm 0.05$	$0.20 \pm 0.05$	2002-2008	$2.94 \pm 1.88$	11.0
2007 YZ	1.04	0.36	16.42	$0.53 \pm 0.10$	$0.09 \pm 0.04$	2007-2011	$2.93 \pm 2.23$	19.3
(85989) 1999 JD6	0.88	0.63	17.05	$1.46 \pm 0.02$	$0.13 \pm 0.03$	1999-2010	$2.93 \pm 1.63$	24.7
(164201) 2004 EC	2.00	0.86	34.64	$2.87 \pm 0.57$	$0.12 \pm 0.04$	2004-2010	$2.88 \pm 1.65$	7.1
(87024) 2000 JS66	1.20	0.19	14.43	$0.31 \pm 0.06$	$0.63 \pm 0.34$	2000-2009	$2.86 \pm 2.14$	15.3
(252558) 2001 WT1	1.09	0.40	7.15	$0.53 \pm 0.03$	$0.06 \pm 0.01$	2001-2010	$2.84 \pm 2.00$	17.5
(162483) 2000 PJ5	0.87	0.37	51.18	$0.92 \pm 0.01$	$0.23 \pm 0.03$	2000-2010	$2.84 \pm 1.61$	24.3
2010 LU134	1.90	0.55	27.38	$0.32 \pm 0.03$	$0.44 \pm 0.11$	138 days	$2.81 \pm 1.85$	7.5
(38086) Beowulf	1.42	0.57	23.67	$0.70 \pm 0.20$	$0.37 \pm 0.12$	1992-2011	$2.79 \pm 3.43$	11.5
2010 OC103	1.19	0.67	23.11	$1.47 \pm 0.31$	$0.02 \pm 0.01$	2006-2011	$2.78 \pm 1.60$	14.9
2010 DJ56	1.25	0.25	34.84	$0.32 \pm 0.05$	$0.33 \pm 0.15$	2003-2010	$2.76 \pm 2.30$	13.8
2010 JF88	2.23	0.66	17.45	$0.45 \pm 0.01$	$0.32 \pm 0.07$	2010-2011	$2.74 \pm 2.25$	5.8
(162416) 2000 EH26	1.85	0.48	0.40	$0.14 \pm 0.03$	$0.18 \pm 0.14$	2000-2005	$2.70 \pm 3.05$	7.5
2007 MK13	1.02	0.14	19.88	$0.39 \pm 0.01$	$0.12 \pm 0.02$	2007-2011	$2.69 \pm 2.10$	18.1
2006 LF	2.14	0.66	7.97	$0.50 \pm 0.10$	$0.25 \pm 0.08$	2002-2009	$2.66 \pm 1.97$	5.9
2008 WB59	1.04	0.19	25.65	$0.41 \pm 0.07$	$0.20 \pm 0.10$	2008-2010	$2.63 \pm 1.97$	17.2
2010 JA35	2.16	0.58	29.00	$0.31 \pm 0.05$	$0.11 \pm 0.06$	201 days	$2.62 \pm 2.22$	5.8
2005 EJ	1.45	0.15	12.46	$0.23 \pm 0.04$	$0.43 \pm 0.24$	2005-2012	$2.57 \pm 2.31$	10.4
2010 FO92	2.14	0.52	6.75	$0.25 \pm 0.01$	$0.28 \pm 0.05$	238 days	$2.55 \pm 2.05$	5.7
2010 CN44	2.85	0.68	3.84	$0.34 \pm 0.01$	$0.19 \pm 0.04$	115 days	$2.55 \pm 1.93$	3.7
2009 UX17	1.19	0.08	10.80	$0.31 \pm 0.01$	$0.04 \pm 0.01$	134 days	$2.54 \pm 2.19$	13.7
2010 GV147	0.96	0.66	44.05	$2.05 \pm 0.04$	$0.02 \pm 0.00$	2010-2011	$2.51 \pm 1.24$	18.7
2010 FQ	1.53	0.36	10.55	$0.29 \pm 0.00$	$0.21 \pm 0.03$	2010-2012	$2.50 \pm 1.81$	9.3
(138947) 2001 BA40	1.12	0.25	12.85	$0.44 \pm 0.09$	$0.42 \pm 0.26$	2001-2007	$2.48 \pm 2.01$	14.7
(207945) 1991 JW	1.04	0.12	8.71	$0.42 \pm 0.03$	$0.16 \pm 0.04$	1955-2009	$2.45 \pm 1.89$	16.2

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2010 DM21	2.86	0.66	21.14	$0.30 \pm 0.01$	$0.13 \pm 0.02$	48 days	$2.44 \pm 1.84$	3.5
2006 KD1	2.48	0.78	30.71	$1.14 \pm 0.12$	$0.18 \pm 0.05$	2006-2010	$2.41 \pm 1.67$	4.3
(221980) 1996 EO	1.34	0.40	21.60	$0.43 \pm 0.05$	$0.20 \pm 0.05$	1996-2009	$2.40 \pm 1.85$	10.8
(52381) 1993 HA	1.28	0.14	7.73	$0.34 \pm 0.10$	$0.14 \pm 0.11$	1993-2009	$2.39 \pm 2.83$	11.6
1998 SB15	1.23	0.16	15.63	$0.34 \pm 0.03$	$0.06 \pm 0.01$	1998-2010	$2.36 \pm 1.95$	12.1
2010 HZ108	1.25	0.21	22.88	$0.36 \pm 0.07$	$0.06 \pm 0.03$	180 days	$2.32 \pm 1.93$	11.7
(99942) Apophis	0.92	0.19	3.33	$0.27 \pm 0.06$	$0.33 \pm 0.08$	2004-2012	$2.32 \pm 2.29$	18.3
(239849) 1999 VO11	2.25	0.64	15.80	$0.45 \pm 0.06$	$0.32 \pm 0.13$	1999-2010	$2.31 \pm 1.76$	4.8
2003 WD158	1.43	0.41	16.71	$0.44 \pm 0.09$	$0.29 \pm 0.09$	2003-2008	$2.30 \pm 1.94$	9.5
(238456) 2004 RK	1.39	0.30	18.15	$0.33 \pm 0.04$	$0.31 \pm 0.14$	1986-2010	$2.30 \pm 1.87$	9.8
(275558) 1999 RH33	1.55	0.17	11.02	$0.23 \pm 0.04$	$0.73 \pm 0.35$	1999-2012	$2.27 \pm 1.89$	8.2
(55408) 2001 TC2	1.10	0.22	30.39	$0.46 \pm 0.01$	$0.34 \pm 0.05$	1979-2010	$2.27 \pm 1.60$	13.8
2009 SO103	2.00	0.66	29.46	$0.67 \pm 0.01$	$0.43 \pm 0.07$	2006-2010	$2.27 \pm 1.56$	5.6
2009 UK	1.98	0.48	3.53	$0.28 \pm 0.02$	$0.22 \pm 0.05$	1984-2010	$2.25 \pm 1.74$	5.6
(3200) Phaethon	1.27	0.89	22.23	$11.00 \pm 0.40$	$0.02 \pm 0.01$	1983-2012	$2.21 \pm 0.74$	10.8
2007 FE1	2.02	0.55	9.85	$0.39 \pm 0.01$	$0.35 \pm 0.07$	2007-2010	$2.21 \pm 1.89$	5.4
(85938) 1999 DJ4	1.85	0.48	9.15	$0.48 \pm 0.10$	$0.28 \pm 0.23$	1999-2009	$2.18 \pm 1.86$	6.0
(163132) 2002 CU11	1.22	0.30	48.77	$0.46 \pm 0.02$	$0.41 \pm 0.06$	2002-2010	$2.17 \pm 1.70$	11.3
(140158) 2001 SX169	1.35	0.46	2.51	$0.57 \pm 0.01$	$0.29 \pm 0.06$	2001-2009	$2.15 \pm 1.59$	9.6
(277039) 2005 CF41	1.65	0.59	15.89	$0.68 \pm 0.02$	$0.16 \pm 0.03$	2005-2011	$2.12 \pm 1.49$	7.0
2010 EX119	1.90	0.60	15.57	$0.56 \pm 0.01$	$0.08 \pm 0.01$	2010-2010	$2.10 \pm 1.58$	5.6
2010 FB81	2.58	0.60	9.48	$0.32 \pm 0.01$	$0.05 \pm 0.01$	118 days	$2.10 \pm 1.69$	3.5
2009 VO24	1.55	0.46	6.05	$0.47 \pm 0.02$	$0.10 \pm 0.02$	2009-2011	$2.08 \pm 1.73$	7.6
2010 JG88	1.37	0.38	30.61	$0.46 \pm 0.01$	$0.14 \pm 0.02$	2010-2010	$2.08 \pm 1.60$	9.0
2010 GE25	2.07	0.47	21.65	$0.30 \pm 0.05$	$0.23 \pm 0.10$	40 days	$2.05 \pm 1.84$	4.8
2010 JN33	1.72	0.34	55.30	$0.29 \pm 0.01$	$0.09 \pm 0.02$	4 days	$2.05 \pm 1.74$	6.4
(262623) 2006 WY2	0.98	0.33	27.55	$0.76 \pm 0.08$	$0.12 \pm 0.04$	2006-2012	$2.05 \pm 1.55$	14.7
2006 OD7	1.33	0.17	30.33	$0.33 \pm 0.07$	$0.27 \pm 0.08$	2006-2009	$2.04 \pm 1.71$	9.3
(5604) 1992 FE	0.93	0.41	4.79	$0.96 \pm 0.01$	$0.52 \pm 0.08$	1985-2010	$1.99 \pm 1.33$	15.6
2007 JZ20	1.31	0.34	40.48	$0.48 \pm 0.04$	$0.31 \pm 0.07$	2004-2010	$1.97 \pm 1.47$	9.2

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
1998 OK1	1.36	0.43	13.99	$0.56 \pm 0.01$	$0.10 \pm 0.02$	1998-2010	$1.96 \pm 1.38$	8.7
2010 AE	1.49	0.38	15.97	$0.41 \pm 0.00$	$0.18 \pm 0.04$	2010-2010	$1.96 \pm 1.74$	7.6
(218017) 2001 XV266	1.20	0.19	12.00	$0.45 \pm 0.01$	$0.12 \pm 0.03$	2001-2010	$1.95 \pm 1.66$	10.4
(302591) 2002 QE7	1.47	0.18	12.11	$0.32 \pm 0.06$	$0.34 \pm 0.20$	2002-2011	$1.95 \pm 1.93$	7.7
2000 CO101	1.08	0.09	15.32	$0.53 \pm 0.16$	$0.11 \pm 0.19$	2000-2011	$1.93 \pm 1.61$	12.1
2010 JE	2.78	0.66	13.90	$0.41 \pm 0.05$	$0.09 \pm 0.03$	194 days	$1.93 \pm 1.46$	2.9
(238063) 2003 EG	1.74	0.71	31.75	$1.47 \pm 0.30$	$0.23 \pm 0.13$	1996-2010	$1.92 \pm 1.24$	5.9
2005 ED318	1.85	0.45	2.39	$0.20 \pm 0.01$	$0.21 \pm 0.04$	2005-2010	$1.87 \pm 1.77$	5.2
2010 FC81	2.67	0.63	1.68	$0.40 \pm 0.01$	$0.02 \pm 0.00$	97 days	$1.87 \pm 1.71$	3.0
(65679) 1989 UQ	0.92	0.26	1.29	$0.73 \pm 0.18$	$0.06 \pm 0.06$	1954-2011	$1.85 \pm 1.59$	14.8
2010 KB61	1.27	0.23	44.60	$0.42 \pm 0.01$	$0.06 \pm 0.01$	189 days	$1.85 \pm 1.51$	9.0
(138911) 2001 AE2	1.35	0.08	1.66	$0.34 \pm 0.07$	$0.34 \pm 0.22$	1984-2012	$1.83 \pm 1.61$	8.2
1998 SE36	1.34	0.10	11.68	$0.34 \pm 0.07$	$0.30 \pm 0.22$	1998-2009	$1.83 \pm 1.40$	8.2
2009 XD	2.45	0.67	31.47	$0.62 \pm 0.02$	$0.15 \pm 0.03$	2009-2010	$1.83 \pm 1.30$	3.3
2010 MF1	2.50	0.59	9.12	$0.36 \pm 0.00$	$0.18 \pm 0.03$	177 days	$1.82 \pm 1.35$	3.2
(152889) 2000 CF59	1.68	0.64	41.59	$1.02 \pm 0.02$	$0.39 \pm 0.07$	1998-2010	$1.79 \pm 1.26$	5.8
(154035) 2002 CV59	1.21	0.53	49.06	$1.10 \pm 0.12$	$0.15 \pm 0.03$	2002-2010	$1.79 \pm 1.26$	9.4
(152978) 2000 GJ147	1.16	0.24	25.01	$0.53 \pm 0.01$	$0.11 \pm 0.02$	2000-2010	$1.79 \pm 1.40$	10.0
2010 DW1	1.22	0.20	23.77	$0.45 \pm 0.00$	$0.09 \pm 0.01$	2002-2010	$1.78 \pm 1.36$	9.2
(138937) 2001 BK16	2.07	0.68	31.83	$0.92 \pm 0.20$	$0.21 \pm 0.06$	1998-2010	$1.78 \pm 1.30$	4.2
2010 HR80	1.35	0.50	26.71	$0.78 \pm 0.01$	$0.02 \pm 0.00$	2010-2010	$1.77 \pm 1.21$	7.9
2010 MR87	1.73	0.39	34.98	$0.36 \pm 0.06$	$0.22 \pm 0.10$	2003-2010	$1.76 \pm 1.36$	5.4
2009 WC26	2.17	0.70	12.02	$0.92 \pm 0.01$	$0.23 \pm 0.04$	2007-2010	$1.76 \pm 1.23$	3.8
2003 SL5	2.11	0.47	6.10	$0.34 \pm 0.07$	$0.38 \pm 0.22$	2003-2009	$1.75 \pm 1.72$	4.0
2010 JM151	1.70	0.48	16.64	$0.54 \pm 0.02$	$0.09 \pm 0.02$	2010-2012	$1.68 \pm 1.30$	5.3
2010 MU112	1.76	0.54	48.02	$0.60 \pm 0.02$	$0.03 \pm 0.01$	134 days	$1.68 \pm 1.23$	5.0
2010 GZ6	1.40	0.14	44.84	$0.37 \pm 0.06$	$0.21 \pm 0.07$	2002-2010	$1.67 \pm 1.55$	7.0
2010 NT1	1.46	0.22	39.52	$0.38 \pm 0.06$	$0.21 \pm 0.08$	99 days	$1.67 \pm 1.65$	6.6
(105141) 2000 NF11	1.42	0.19	14.82	$0.35 \pm 0.05$	$0.43 \pm 0.14$	1978-2005	$1.67 \pm 1.20$	6.9
(9162) Kwiila	1.50	0.60	9.02	$1.13 \pm 0.23$	$0.09 \pm 0.04$	1987-2009	$1.66 \pm 1.28$	6.4

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2010 FZ80	2.78	0.74	25.72	$0.87 \pm 0.01$	$0.02 \pm 0.00$	2010-2010	$1.65 \pm 1.14$	2.5
2010 LF64	1.34	0.16	18.25	$0.35 \pm 0.01$	$0.03 \pm 0.01$	2 days	$1.65 \pm 1.40$	7.4
2010 CP140	1.90	0.54	14.47	$0.56 \pm 0.10$	$0.11 \pm 0.03$	127 days	$1.62 \pm 1.19$	4.3
2010 LT108	1.35	0.37	31.87	$0.60 \pm 0.01$	$0.06 \pm 0.01$	90 days	$1.59 \pm 1.33$	7.1
(22099) 2000 EX106	1.10	0.28	9.84	$0.62 \pm 0.11$	$0.29 \pm 0.16$	1994-2008	$1.58 \pm 1.17$	9.5
2003 QH5	1.26	0.22	17.61	$0.54 \pm 0.09$	$0.06 \pm 0.03$	2003-2010	$1.58 \pm 1.38$	7.8
2009 ST103	2.69	0.72	15.94	$0.85 \pm 0.01$	$0.14 \pm 0.02$	2000-2010	$1.57 \pm 1.17$	2.5
1999 TX2	1.28	0.46	61.39	$0.96 \pm 0.19$	$0.11 \pm 0.03$	1999-2005	$1.57 \pm 1.36$	7.6
(52750) 1998 KK17	1.43	0.52	11.16	$1.06 \pm 0.01$	$0.39 \pm 0.08$	1992-2009	$1.57 \pm 1.01$	6.4
2010 GU21	2.18	0.56	3.19	$0.51 \pm 0.04$	$0.02 \pm 0.01$	136 days	$1.56 \pm 1.20$	3.4
(90373) 2003 SZ219	1.63	0.20	9.87	$0.31 \pm 0.05$	$0.58 \pm 0.30$	1998-2007	$1.56 \pm 1.28$	5.3
(172974) 2005 YW55	1.64	0.25	8.47	$0.34 \pm 0.08$	$0.30 \pm 0.24$	2002-2011	$1.55 \pm 1.46$	5.2
(280136) 2002 OM4	1.50	0.56	55.32	$1.03 \pm 0.20$	$0.30 \pm 0.09$	2002-2011	$1.55 \pm 1.18$	5.9
1993 RA	1.92	0.42	5.61	$0.36 \pm 0.06$	$0.40 \pm 0.23$	1993-2010	$1.54 \pm 1.25$	4.1
(10302) 1989 ML	1.27	0.14	4.38	$0.24 \pm 0.04$	$0.49 \pm 0.28$	1989-2006	$1.53 \pm 1.37$	7.5
2010 FJ81	3.59	0.69	42.26	$0.42 \pm 0.01$	$0.05 \pm 0.01$	174 days	$1.52 \pm 1.31$	1.6
2010 FY80	2.69	0.61	18.86	$0.45 \pm 0.01$	$0.12 \pm 0.02$	128 days	$1.52 \pm 1.17$	2.4
(25143) Itokawa	1.32	0.28	1.62	$0.45 \pm 0.18$	$0.41 \pm 0.20$	1998-2010	$1.50 \pm 2.29$	6.9
2000 GV147	1.75	0.46	10.57	$0.50 \pm 0.10$	$0.19 \pm 0.12$	2000-2009	$1.50 \pm 1.15$	4.6
2010 CN1	1.50	0.44	20.97	$0.64 \pm 0.06$	$0.12 \pm 0.04$	2010-2011	$1.49 \pm 1.22$	5.7
2010 DH77	3.27	0.71	34.37	$0.58 \pm 0.01$	$0.01 \pm 0.00$	107 days	$1.49 \pm 1.18$	1.8
(226198) 2002 UN3	1.74	0.26	8.70	$0.31 \pm 0.05$	$0.67 \pm 0.35$	1994-2009	$1.49 \pm 1.30$	4.5
(263976) 2009 KD5	1.05	0.26	13.47	$0.78 \pm 0.01$	$0.13 \pm 0.02$	1950-2012	$1.47 \pm 1.04$	9.6
(164121) 2003 YT1	1.11	0.29	44.06	$1.10 \pm 0.08$	$0.49 \pm 0.04$	1982-2011	$1.46 \pm 1.04$	8.8
2001 HA4	2.68	0.80	17.20	$1.85 \pm 0.04$	$0.05 \pm 0.01$	2001-2010	$1.44 \pm 0.99$	2.3
(215442) 2002 MQ3	0.91	0.27	36.28	$1.05 \pm 0.02$	$0.08 \pm 0.00$	2002-2009	$1.44 \pm 0.91$	11.6
(42286) 2001 TN41	1.42	0.39	24.07	$0.70 \pm 0.20$	$1.00 \pm 0.30$	1975-2012	$1.43 \pm 1.23$	5.9
2010 CH18	2.61	0.57	27.15	$0.39 \pm 0.01$	$0.26 \pm 0.04$	128 days	$1.42 \pm 1.17$	2.4
2002 YF4	1.75	0.33	33.68	$0.38 \pm 0.01$	$0.43 \pm 0.05$	2002-2010	$1.41 \pm 1.07$	4.2
2004 JX20	0.90	0.27	10.52	$1.13 \pm 0.01$	$0.02 \pm 0.00$	2004-2011	$1.40 \pm 1.02$	11.4

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(153220) 2000 YN29	2.53	0.68	5.87	$0.81 \pm 0.16$	$0.27 \pm 0.09$	1997-2009	$1.40 \pm 1.09$	2.4
(152931) 2000 EA107	0.93	0.46	28.58	$1.65 \pm 0.04$	$0.24 \pm 0.04$	2000-2011	$1.39 \pm 0.86$	10.9
2005 XD1	1.62	0.31	18.29	$0.41 \pm 0.01$	$0.18 \pm 0.03$	2005-2011	$1.39 \pm 1.13$	4.7
(220124) 2002 TE66	1.46	0.38	51.34	$0.61 \pm 0.03$	$0.21 \pm 0.04$	2002-2009	$1.37 \pm 1.01$	5.4
(99799) 2002 LJ3	1.46	0.28	7.56	$0.49 \pm 0.10$	$0.42 \pm 0.25$	1989-2012	$1.34 \pm 1.09$	5.3
2009 UP1	1.52	0.40	17.28	$0.61 \pm 0.02$	$0.04 \pm 0.01$	95 days	$1.34 \pm 0.94$	5.0
(242147) 2003 BH84	1.96	0.72	23.40	$1.69 \pm 0.01$	$0.11 \pm 0.03$	2003-2010	$1.33 \pm 0.88$	3.4
2009 SX1	1.72	0.45	8.29	$0.56 \pm 0.01$	$0.17 \pm 0.03$	2002-2010	$1.32 \pm 1.09$	4.1
2010 GH65	2.71	0.61	21.08	$0.49 \pm 0.02$	$0.24 \pm 0.06$	2001-2010	$1.31 \pm 1.18$	2.1
(237551) 2000 WQ19	1.41	0.35	34.28	$0.63 \pm 0.04$	$0.23 \pm 0.05$	2000-2010	$1.30 \pm 0.97$	5.5
(306462) 1999 RC32	1.84	0.43	30.97	$0.48 \pm 0.06$	$0.38 \pm 0.09$	1999-2010	$1.30 \pm 1.12$	3.7
2010 BH2	2.35	0.46	24.62	$0.36 \pm 0.07$	$0.21 \pm 0.10$	149 days	$1.29 \pm 1.23$	2.5
(6489) Golevka	2.50	0.61	2.28	$0.53 \pm 0.03$	$0.15 \pm 0.02$	1991-2011	$1.25 \pm 1.14$	2.2
(9202) 1993 PB	1.42	0.61	40.82	$1.62 \pm 0.05$	$0.27 \pm 0.06$	1993-2009	$1.25 \pm 0.78$	5.1
2010 HQ80	1.57	0.49	27.86	$0.89 \pm 0.15$	$0.02 \pm 0.01$	2010-2010	$1.25 \pm 1.11$	4.4
(55532) 2001 WG2	1.79	0.70	38.50	$1.96 \pm 0.40$	$0.14 \pm 0.04$	1953-2006	$1.24 \pm 0.95$	3.6
2010 LR33	1.69	0.46	5.83	$0.66 \pm 0.01$	$0.21 \pm 0.04$	2001-2012	$1.23 \pm 1.04$	3.9
2008 EB9	1.56	0.22	21.35	$0.43 \pm 0.08$	$0.07 \pm 0.04$	2008-2010	$1.23 \pm 0.96$	4.4
(4660) Nereus	1.49	0.36	1.43	$0.40 \pm 0.10$	$0.55 \pm 0.17$	1981-2010	$1.23 \pm 1.37$	4.7
(161999) 1989 RC	2.31	0.52	7.39	$0.46 \pm 0.02$	$0.21 \pm 0.04$	1989-2010	$1.20 \pm 0.91$	2.4
(152964) 2000 GP82	1.40	0.39	13.22	$0.79 \pm 0.15$	$0.34 \pm 0.18$	1995-2010	$1.20 \pm 0.88$	5.1
2002 WP	1.45	0.22	19.15	$0.52 \pm 0.08$	$0.32 \pm 0.13$	2002-2010	$1.19 \pm 1.06$	4.8
2010 GX62	2.95	0.70	21.64	$0.79 \pm 0.01$	$0.01 \pm 0.00$	180 days	$1.17 \pm 0.86$	1.6
2006 EE1	1.20	0.28	36.40	$0.78 \pm 0.02$	$0.04 \pm 0.01$	2006-2010	$1.17 \pm 0.80$	6.2
2009 AV	1.03	0.07	45.87	$0.87 \pm 0.02$	$0.15 \pm 0.03$	2009-2012	$1.16 \pm 0.90$	7.7
(138359) 2000 GX127	1.14	0.36	20.24	$1.08 \pm 0.03$	$0.09 \pm 0.02$	2000-2010	$1.15 \pm 0.84$	6.6
2009 SP	2.22	0.49	25.28	$0.48 \pm 0.10$	$0.12 \pm 0.07$	168 days	$1.15 \pm 1.03$	2.4
(159686) 2002 LB6	1.80	0.69	24.69	$1.84 \pm 0.01$	$0.17 \pm 0.03$	1997-2010	$1.13 \pm 0.68$	3.3
2010 CG18	1.44	0.23	10.16	$0.56 \pm 0.02$	$0.02 \pm 0.00$	2010-2011	$1.12 \pm 0.94$	4.6
2007 WV4	1.49	0.44	38.34	$0.89 \pm 0.16$	$0.04 \pm 0.02$	2007-2010	$1.11 \pm 0.85$	4.3



Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2005 JA22	1.53	0.30	13.24	$0.67 \pm 0.17$	$0.16 \pm 0.12$	2005-2012	$1.10 \pm 1.07$	4.0
2010 DM56	1.31	0.29	25.61	$0.77 \pm 0.00$	$0.02 \pm 0.00$	121 days	$1.09 \pm 0.84$	5.1
(35107) 1991 VH	1.14	0.14	13.91	$1.12 \pm 0.23$	$0.27 \pm 0.20$	1991-2008	$1.08 \pm 0.92$	6.2
2002 NW16	1.11	0.03	14.16	$0.85 \pm 0.01$	$0.16 \pm 0.03$	2002-2011	$1.05 \pm 0.87$	6.3
(277616) 2006 BN6	2.56	0.71	18.38	$1.24 \pm 0.01$	$0.13 \pm 0.03$	2002-2010	$1.04 \pm 0.74$	1.8
(137805) 1999 YK5	0.83	0.56	16.74	$3.88 \pm 0.16$	$0.03 \pm 0.01$	1999-2012	$1.03 \pm 0.57$	9.5
(161989) Cacus	1.12	0.21	26.06	$1.13 \pm 0.07$	$0.20 \pm 0.05$	1978-2010	$1.02 \pm 0.85$	6.0
2010 CD19	2.26	0.58	20.70	$0.74 \pm 0.01$	$0.25 \pm 0.05$	2009-2010	$1.02 \pm 0.84$	2.1
(3671) Dionysus	2.20	0.54	13.55	$0.89 \pm 0.11$	$0.67 \pm 0.37$	1984-2011	$1.02 \pm 0.80$	2.2
2002 NP1	1.25	0.17	19.12	$0.81 \pm 0.16$	$0.25 \pm 0.08$	2002-2010	$1.02 \pm 0.91$	5.1
(1865) Cerberus	1.08	0.47	16.10	$1.61 \pm 0.01$	$0.14 \pm 0.02$	1971-2008	$1.00 \pm 0.68$	6.3
(4197) 1982 TA	2.30	0.77	12.57	$3.04 \pm 0.16$	$0.28 \pm 0.08$	1954-2010	$1.00 \pm 0.62$	2.0
2007 DK8	1.65	0.42	32.57	$0.79 \pm 0.16$	$0.08 \pm 0.03$	2007-2009	$0.98 \pm 0.86$	3.2
(1915) Quetzalcoatl	2.54	0.57	20.41	$0.75 \pm 0.25$	$0.09 \pm 0.09$	1953-2004	$0.97 \pm 1.10$	1.7
(3757) 1982 XB	1.83	0.45	3.87	$0.50 \pm 0.10$	$0.12 \pm 0.13$	1982-2008	$0.97 \pm 0.76$	2.7
(235756) 2004 VC	1.13	0.26	39.15	$1.14 \pm 0.03$	$0.04 \pm 0.01$	1992-2010	$0.96 \pm 0.79$	5.6
2010 DH56	2.24	0.57	33.65	$0.77 \pm 0.02$	$0.02 \pm 0.01$	44 days	$0.95 \pm 0.70$	2.0
2010 KY39	1.74	0.40	25.51	$0.68 \pm 0.01$	$0.03 \pm 0.00$	167 days	$0.94 \pm 0.85$	2.9
(162463) 2000 JH5	1.15	0.24	22.21	$1.05 \pm 0.08$	$0.16 \pm 0.04$	2000-2011	$0.94 \pm 0.75$	5.4
2010 LG64	2.67	0.61	42.32	$1.12 \pm 0.49$	$0.01 \pm 0.00$	139 days	$0.94 \pm 2.30$	1.5
2010 KZ117	2.27	0.51	33.16	$0.62 \pm 0.01$	$0.09 \pm 0.02$	166 days	$0.93 \pm 0.80$	1.9
(177614) 2004 HK33	1.89	0.52	5.44	$0.94 \pm 0.18$	$0.19 \pm 0.14$	2001-2009	$0.93 \pm 0.74$	2.5
(7335) 1989 JA	1.77	0.48	15.21	$0.93 \pm 0.15$	$0.32 \pm 0.15$	1989-2008	$0.93 \pm 0.91$	2.8
2010 JL33	2.66	0.74	5.33	$1.78 \pm 0.03$	$0.05 \pm 0.01$	1997-2011	$0.93 \pm 0.71$	1.5
2004 RA11	1.82	0.40	39.36	$0.63 \pm 0.06$	$0.14 \pm 0.04$	2004-2010	$0.92 \pm 0.78$	2.6
(175706) 1996 FG3	1.05	0.35	1.99	$1.90 \pm 0.52$	$0.03 \pm 0.03$	1996-2012	$0.92 \pm 0.73$	5.9
(68359) 2001 OZ13	1.52	0.17	9.86	$0.62 \pm 0.15$	$0.42 \pm 0.27$	1995-2010	$0.90 \pm 0.69$	3.4
(283729) 2002 UX	1.47	0.16	20.21	$0.65 \pm 0.13$	$0.31 \pm 0.10$	2002-2012	$0.90 \pm 0.84$	3.5
(153814) 2001 WN5	1.71	0.47	1.92	$0.93 \pm 0.01$	$0.10 \pm 0.02$	1996-2010	$0.89 \pm 0.74$	2.8
(7822) 1991 CS	1.12	0.16	37.12	$1.44 \pm 0.01$	$0.09 \pm 0.01$	1991-2010	$0.89 \pm 0.66$	5.2

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(142464) 2002 TC9	1.23	0.15	16.28	$0.89 \pm 0.01$	$0.12 \pm 0.02$	1991-2006	$0.88 \pm 0.73$	4.5
2005 WE	1.15	0.25	12.36	$1.15 \pm 0.01$	$0.02 \pm 0.00$	2005-2011	$0.88 \pm 0.68$	5.0
2010 JF87	2.44	0.62	24.93	$0.94 \pm 0.01$	$0.04 \pm 0.01$	65 days	$0.86 \pm 0.66$	1.6
(222869) 2002 FB6	1.80	0.54	33.70	$1.20 \pm 0.24$	$0.14 \pm 0.03$	2002-2009	$0.85 \pm 0.72$	2.5
1989 AZ	1.65	0.47	11.78	$1.09 \pm 0.20$	$0.03 \pm 0.02$	1989-2008	$0.85 \pm 0.69$	2.8
(90367) 2003 LC5	1.16	0.43	16.88	$1.75 \pm 0.00$	$0.05 \pm 0.01$	1983-2008	$0.85 \pm 0.57$	4.8
2010 KK127	2.23	0.42	6.94	$0.50 \pm 0.02$	$0.03 \pm 0.01$	177 days	$0.84 \pm 0.65$	1.8
(5143) Heracles	1.83	0.77	9.03	$4.84 \pm 0.38$	$0.23 \pm 0.05$	1953-2011	$0.83 \pm 0.48$	2.3
(242187) 2003 KR18	2.34	0.48	5.58	$0.65 \pm 0.13$	$0.29 \pm 0.15$	1985-2010	$0.82 \pm 1.64$	1.6
(311321) 2005 NP1	1.83	0.30	34.70	$0.58 \pm 0.11$	$0.17 \pm 0.09$	2005-2012	$0.82 \pm 0.70$	2.3
2010 HD33	2.62	0.52	24.48	$0.56 \pm 0.10$	$0.27 \pm 0.13$	134 days	$0.80 \pm 0.63$	1.3
(10115) 1992 SK	1.25	0.32	15.32	$1.00 \pm 0.08$	$0.28 \pm 0.14$	1953-1999	$0.80 \pm 0.68$	4.0
(185716) 1998 SF35	1.69	0.27	35.19	$0.63 \pm 0.10$	$0.34 \pm 0.15$	1998-2009	$0.80 \pm 0.62$	2.6
2007 RM133	2.21	0.44	10.75	$0.59 \pm 0.08$	$0.27 \pm 0.08$	2007-2010	$0.80 \pm 0.66$	1.7
(254419) 2004 VT60	2.08	0.43	43.53	$0.63 \pm 0.02$	$0.41 \pm 0.09$	2001-2010	$0.79 \pm 0.62$	1.9
(7839) 1994 ND	2.16	0.52	27.18	$0.78 \pm 0.01$	$0.18 \pm 0.03$	1994-2010	$0.79 \pm 0.57$	1.7
2003 WO7	2.15	0.43	7.67	$0.68 \pm 0.16$	$0.11 \pm 0.07$	2003-2009	$0.79 \pm 0.77$	1.7
2004 TB18	1.82	0.45	13.20	$0.86 \pm 0.01$	$0.20 \pm 0.04$	2004-2011	$0.78 \pm 0.62$	2.2
(137062) 1998 WM	1.22	0.32	22.52	$1.27 \pm 0.04$	$0.28 \pm 0.07$	1987-2010	$0.77 \pm 0.53$	4.0
2010 FX80	2.17	0.45	36.94	$0.68 \pm 0.13$	$0.02 \pm 0.01$	84 days	$0.77 \pm 0.73$	1.7
2006 AD	1.05	0.49	54.98	$3.06 \pm 0.61$	$0.04 \pm 0.02$	2006-2009	$0.75 \pm 0.53$	4.9
2010 GY6	1.29	0.23	21.91	$1.10 \pm 0.08$	$0.03 \pm 0.01$	240 days	$0.74 \pm 0.68$	3.6
2005 SC71	1.91	0.38	32.37	$0.74 \pm 0.15$	$0.15 \pm 0.11$	2005-2010	$0.74 \pm 0.71$	2.0
2002 HF8	2.32	0.49	4.78	$0.71 \pm 0.16$	$0.18 \pm 0.14$	2002-2009	$0.73 \pm 0.66$	1.5
2009 WN	1.38	0.22	32.79	$0.95 \pm 0.04$	$0.06 \pm 0.01$	2002-2010	$0.73 \pm 0.59$	3.1
(315508) 2008 AB31	1.60	0.32	30.02	$0.82 \pm 0.05$	$0.02 \pm 0.01$	2002-2012	$0.72 \pm 0.62$	2.5
(29075) 1950 DA	1.70	0.51	12.18	$2.00 \pm 0.20$	$0.07 \pm 0.02$	1950-2012	$0.71 \pm 0.54$	2.2
(89959) 2002 NT7	1.74	0.53	42.33	$1.41 \pm 0.08$	$0.22 \pm 0.05$	1954-2011	$0.71 \pm 0.51$	2.2
(142563) 2002 TR69	1.66	0.34	20.49	$0.86 \pm 0.14$	$0.38 \pm 0.17$	1997-2012	$0.70 \pm 0.56$	2.3
2010 OK126	1.96	0.45	52.54	$0.85 \pm 0.01$	$0.01 \pm 0.00$	129 days	$0.70 \pm 0.61$	1.8

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(162903) 2001 JV2	1.30	0.24	47.49	$1.09 \pm 0.01$	$0.06 \pm 0.02$	2001-2010	$0.69 \pm 0.55$	3.3
2003 UL12	3.29	0.70	19.73	$1.08 \pm 0.02$	$0.20 \pm 0.05$	1998-2010	$0.69 \pm 0.50$	0.8
(139345) 2001 KA67	1.80	0.70	22.37	$3.10 \pm 0.14$	$0.04 \pm 0.01$	2001-2010	$0.68 \pm 0.47$	2.0
(3908) Nyx	1.93	0.46	2.18	$1.00 \pm 0.15$	$0.16 \pm 0.08$	1980-2009	$0.67 \pm 0.54$	1.7
(2102) Tantalus	1.29	0.30	64.01	$1.81 \pm 0.22$	$0.21 \pm 0.08$	1975-2008	$0.66 \pm 0.51$	3.2
2010 EH43	1.28	0.04	37.55	$0.99 \pm 0.02$	$0.05 \pm 0.01$	2010-2010	$0.66 \pm 0.52$	3.2
(2100) Ra-Shalom	0.83	0.44	15.76	$2.30 \pm 0.20$	$0.13 \pm 0.03$	1975-2009	$0.66 \pm 0.47$	6.1
2007 HX4	1.32	0.33	56.56	$1.39 \pm 0.04$	$0.07 \pm 0.01$	1998-2010	$0.65 \pm 0.52$	3.0
(212546) 2006 SV19	2.13	0.51	7.34	$1.06 \pm 0.23$	$0.13 \pm 0.11$	2003-2009	$0.65 \pm 0.66$	1.5
(66272) 1999 JW6	1.51	0.14	51.32	$0.82 \pm 0.01$	$0.42 \pm 0.06$	1999-2007	$0.64 \pm 0.58$	2.4
(243566) 1995 SA	2.46	0.64	20.06	$1.46 \pm 0.18$	$0.09 \pm 0.03$	1991-2010	$0.64 \pm 0.54$	1.2
(15745) 1991 PM5	1.72	0.25	14.42	$0.80 \pm 0.20$	$0.23 \pm 0.07$	1982-2007	$0.63 \pm 0.55$	2.0
(103067) 1999 XA143	1.84	0.58	38.54	$1.28 \pm 0.03$	$0.25 \pm 0.05$	1994-2010	$0.63 \pm 0.48$	1.8
(85628) 1998 KV2	1.59	0.33	13.03	$1.01 \pm 0.06$	$0.30 \pm 0.08$	1998-2012	$0.62 \pm 0.48$	2.2
(2101) Adonis	1.87	0.76	1.33	$5.73 \pm 0.39$	$0.04 \pm 0.01$	1936-2007	$0.61 \pm 0.36$	1.7
(66251) 1999 GJ2	1.54	0.20	11.28	$1.22 \pm 0.23$	$0.19 \pm 0.09$	1984-2012	$0.61 \pm 0.50$	2.2
2000 HD74	2.92	0.59	49.30	$0.83 \pm 0.02$	$0.16 \pm 0.03$	2000-2010	$0.60 \pm 0.54$	0.8
2000 JA3	2.25	0.46	10.18	$0.77 \pm 0.15$	$0.10 \pm 0.06$	2000-2010	$0.60 \pm 0.47$	1.2
(4953) 1990 MU	1.62	0.66	24.39	$2.26 \pm 0.50$	$0.79 \pm 0.25$	1974-2009	$0.60 \pm 0.44$	2.0
2009 XC2	2.64	0.58	25.77	$0.97 \pm 0.01$	$0.26 \pm 0.03$	1954-2010	$0.60 \pm 0.46$	1.0
(40263) 1999 FQ5	1.49	0.16	25.84	$0.95 \pm 0.19$	$0.18 \pm 0.08$	1994-2012	$0.60 \pm 0.54$	2.3
(12711) Tukmit	1.19	0.27	38.48	$1.90 \pm 0.40$	$0.19 \pm 0.06$	1991-2009	$0.60 \pm 0.47$	3.3
(8566) 1996 EN	1.51	0.43	37.96	$1.57 \pm 0.26$	$0.22 \pm 0.11$	1996-2011	$0.60 \pm 0.46$	2.3
(66008) 1998 QH2	1.43	0.36	61.01	$1.48 \pm 0.28$	$0.32 \pm 0.17$	1996-2008	$0.59 \pm 0.49$	2.4
(2212) Hephaistos	2.16	0.84	11.69	$5.54 \pm 0.04$	$0.16 \pm 0.03$	1978-2011	$0.58 \pm 0.35$	1.3
(215757) 2004 FU64	1.84	0.37	24.88	$0.91 \pm 0.18$	$0.19 \pm 0.06$	1999-2009	$0.58 \pm 0.47$	1.6
(7888) 1993 UC	2.43	0.66	26.08	$2.75 \pm 0.60$	$0.18 \pm 0.06$	1989-2008	$0.58 \pm 0.48$	1.1
(17182) 1999 VU	1.39	0.55	9.27	$2.88 \pm 0.19$	$0.03 \pm 0.01$	1977-2007	$0.58 \pm 0.39$	2.5
(138847) 2000 VE62	1.62	0.29	22.19	$0.97 \pm 0.15$	$0.40 \pm 0.15$	1983-2012	$0.58 \pm 0.48$	2.0
(3554) Amun	0.97	0.28	23.36	$3.33 \pm 0.02$	$0.08 \pm 0.01$	1986-2012	$0.57 \pm 0.39$	4.1

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(17188) 1999 WC2	2.22	0.64	29.41	$1.82 \pm 0.23$	$0.15 \pm 0.04$	1990-2011	$0.57 \pm 0.39$	1.2
(87311) 2000 QJ1	1.59	0.51	7.69	$1.95 \pm 0.14$	$0.14 \pm 0.04$	1982-2011	$0.57 \pm 0.45$	2.0
(218863) 2006 WO127	2.19	0.55	11.00	$1.24 \pm 0.01$	$0.39 \pm 0.09$	2002-2010	$0.57 \pm 0.45$	1.2
(1864) Daedalus	1.46	0.61	22.20	$2.72 \pm 0.11$	$0.27 \pm 0.06$	1971-2006	$0.57 \pm 0.40$	2.2
(138883) 2000 YL29	1.54	0.34	21.89	$1.22 \pm 0.22$	$0.25 \pm 0.12$	1984-2011	$0.56 \pm 0.50$	2.1
(138013) 2000 CN101	1.60	0.63	15.95	$3.52 \pm 0.23$	$0.17 \pm 0.05$	1984-2012	$0.55 \pm 0.41$	1.9
(100004) 1983 VA	2.60	0.70	16.29	$2.70 \pm 0.10$	$0.07 \pm 0.01$	1983-2005	$0.55 \pm 0.40$	0.9
2000 JY8	2.78	0.60	16.53	$1.11 \pm 0.22$	$0.32 \pm 0.09$	2000-2009	$0.54 \pm 0.45$	0.8
(12538) 1998 OH	1.54	0.41	24.53	$1.66 \pm 0.33$	$0.23 \pm 0.12$	1991-2010	$0.54 \pm 0.47$	2.0
2010 AG79	2.91	0.58	32.97	$0.89 \pm 0.01$	$0.02 \pm 0.00$	70 days	$0.53 \pm 0.43$	0.8
2010 VY190	1.81	0.31	19.97	$0.95 \pm 0.22$	$0.04 \pm 0.02$	2010-2011	$0.52 \pm 0.43$	1.5
(11500) Tomaiyowit	1.08	0.36	10.31	$0.74 \pm 0.01$	$0.14 \pm 0.02$	1989-2007	$0.52 \pm 0.36$	3.2
2005 CR37	1.91	0.47	26.07	$1.20 \pm 0.24$	$0.03 \pm 0.02$	2005-2010	$0.51 \pm 0.38$	1.4
2010 LQ33	2.27	0.46	24.60	$0.87 \pm 0.01$	$0.04 \pm 0.01$	164 days	$0.51 \pm 0.45$	1.0
(40329) 1999 ML	2.27	0.45	2.51	$0.96 \pm 0.23$	$0.16 \pm 0.16$	1999-2009	$0.50 \pm 0.43$	1.0
2009 UV18	3.17	0.63	8.34	$1.00 \pm 0.00$	$0.71 \pm 0.10$	2004-2010	$0.50 \pm 0.36$	0.6
(243147) 2007 TX18	2.14	0.42	7.37	$0.91 \pm 0.01$	$0.28 \pm 0.06$	1991-2012	$0.50 \pm 0.43$	1.1
2007 XC10	1.62	0.23	47.94	$1.05 \pm 0.20$	$0.03 \pm 0.01$	2007-2011	$0.50 \pm 0.45$	1.7
(162181) 1999 LF6	1.41	0.28	18.94	$0.86 \pm 0.16$	$0.13 \pm 0.09$	1999-2010	$0.49 \pm 0.43$	2.1
(16834) 1997 WU22	1.47	0.44	15.99	$1.50 \pm 0.30$	$0.40 \pm 0.12$	1988-2012	$0.49 \pm 0.43$	1.9
(144901) 2004 WG1	1.64	0.52	13.06	$2.24 \pm 0.03$	$0.04 \pm 0.01$	2004-2012	$0.48 \pm 0.34$	1.6
(68372) 2001 PM9	1.62	0.42	8.10	$1.73 \pm 0.45$	$0.02 \pm 0.02$	2001-2011	$0.48 \pm 0.44$	1.6
(159402) 1999 AP10	2.38	0.58	7.63	$1.20 \pm 0.30$	$0.34 \pm 0.23$	1999-2009	$0.48 \pm 0.44$	0.9
(2201) Oljato	2.17	0.71	2.52	$1.80 \pm 0.10$	$0.43 \pm 0.03$	1931-2012	$0.48 \pm 0.40$	1.0
(52760) 1998 ML14	2.41	0.62	2.43	$1.00 \pm 0.05$	$0.27 \pm 0.24$	1998-2003	$0.47 \pm 0.39$	0.9
(159399) 1998 UL1	1.53	0.21	41.97	$1.24 \pm 0.25$	$0.27 \pm 0.09$	1998-2011	$0.47 \pm 0.41$	1.7
(88188) 2000 XH44	2.01	0.39	11.37	$1.37 \pm 0.26$	$0.37 \pm 0.17$	1991-2011	$0.46 \pm 0.37$	1.1
2010 KH	2.76	0.55	14.57	$1.03 \pm 0.02$	$0.03 \pm 0.01$	222 days	$0.45 \pm 0.41$	0.7
(3103) Eger	1.40	0.35	20.93	$1.80 \pm 0.30$	$0.39 \pm 0.12$	1982-2012	$0.45 \pm 0.41$	1.9
(85713) 1998 SS49	1.92	0.64	10.76	$3.48 \pm 0.79$	$0.08 \pm 0.04$	1998-2011	$0.44 \pm 0.37$	1.2

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(232382) 2003 BT47	2.34	0.49	7.49	$1.12 \pm 0.00$	$0.16 \pm 0.02$	2003-2011	$0.44 \pm 0.38$	0.9
2010 AB78	2.25	0.55	33.24	$1.52 \pm 0.01$	$0.04 \pm 0.00$	2003-2010	$0.43 \pm 0.35$	0.9
(155334) 2006 DZ169	2.03	0.41	6.62	$1.15 \pm 0.32$	$0.20 \pm 0.18$	1983-2011	$0.43 \pm 0.36$	1.0
2002 LV	2.32	0.60	29.53	$1.73 \pm 0.35$	$0.15 \pm 0.05$	2002-2012	$0.43 \pm 0.38$	0.9
(7350) 1993 VA	1.36	0.39	7.26	$2.36 \pm 0.13$	$0.05 \pm 0.01$	1986-2008	$0.43 \pm 0.36$	1.9
(54401) 2000 LM	1.71	0.26	18.95	$1.19 \pm 0.19$	$0.18 \pm 0.07$	1989-2009	$0.42 \pm 0.38$	1.3
(54686) 2001 DU8	1.78	0.34	33.21	$1.25 \pm 0.25$	$0.34 \pm 0.09$	1988-2011	$0.42 \pm 0.33$	1.3
(85839) 1998 YO4	1.65	0.25	9.33	$1.14 \pm 0.01$	$0.41 \pm 0.08$	1993-2012	$0.42 \pm 0.34$	1.4
2010 MU111	2.40	0.61	41.36	$1.95 \pm 0.01$	$0.02 \pm 0.00$	167 days	$0.42 \pm 0.36$	0.8
2010 CM	2.62	0.54	7.42	$1.17 \pm 0.23$	$0.06 \pm 0.01$	2002-2010	$0.42 \pm 0.39$	0.7
(86067) 1999 RM28	1.82	0.32	30.54	$1.25 \pm 0.21$	$0.31 \pm 0.13$	1989-2011	$0.42 \pm 0.35$	1.2
2000 WC67	2.69	0.57	10.00	$1.31 \pm 0.02$	$0.04 \pm 0.01$	2000-2010	$0.42 \pm 0.36$	0.7
(159608) 2002 AC2	1.67	0.35	58.88	$1.51 \pm 0.30$	$0.20 \pm 0.06$	2002-2011	$0.42 \pm 0.36$	1.3
(230118) 2001 DB3	2.69	0.56	24.48	$1.18 \pm 0.00$	$0.15 \pm 0.02$	2001-2010	$0.42 \pm 0.30$	0.7
2005 LY19	1.60	0.24	30.00	$1.36 \pm 0.27$	$0.26 \pm 0.08$	2005-2011	$0.41 \pm 0.35$	1.4
2009 KC3	3.21	0.70	10.01	$2.19 \pm 0.45$	$0.02 \pm 0.02$	2009-2010	$0.40 \pm 0.33$	0.5
2010 NW1	3.39	0.62	39.55	$1.16 \pm 0.23$	$0.19 \pm 0.10$	109 days	$0.40 \pm 0.40$	0.4
(230979) 2005 AT42	2.86	0.61	11.23	$1.52 \pm 0.04$	$0.21 \pm 0.05$	2004-2010	$0.39 \pm 0.32$	0.6
(86326) 1999 WK13	1.84	0.36	34.30	$1.35 \pm 0.03$	$0.10 \pm 0.02$	1979-2011	$0.38 \pm 0.29$	1.1
2004 YR32	3.06	0.70	20.52	$2.29 \pm 0.28$	$0.03 \pm 0.01$	2004-2010	$0.38 \pm 0.29$	0.5
(153219) 2000 YM29	2.09	0.44	40.33	$1.29 \pm 0.01$	$0.05 \pm 0.01$	2000-2010	$0.38 \pm 0.33$	0.9
(1943) Anteros	1.43	0.26	8.71	$2.40 \pm 0.30$	$0.15 \pm 0.05$	1973-2012	$0.38 \pm 0.34$	1.5
(12923) Zephyr	1.96	0.49	5.29	$2.06 \pm 0.01$	$0.20 \pm 0.03$	1955-2012	$0.36 \pm 0.32$	0.9
(152558) 1990 SA	2.01	0.44	38.12	$1.46 \pm 0.01$	$0.16 \pm 0.02$	1990-2007	$0.36 \pm 0.29$	0.9
2002 XG4	2.26	0.48	21.03	$1.42 \pm 0.04$	$0.05 \pm 0.01$	2002-2010	$0.36 \pm 0.26$	0.7
2010 NG3	2.61	0.56	26.97	$1.52 \pm 0.04$	$0.10 \pm 0.02$	186 days	$0.35 \pm 0.29$	0.6
2010 AH30	2.29	0.55	43.27	$1.86 \pm 0.15$	$0.02 \pm 0.00$	59 days	$0.35 \pm 0.27$	0.7
(214088) 2004 JN13	2.87	0.70	13.33	$2.97 \pm 0.64$	$0.25 \pm 0.08$	1975-2009	$0.35 \pm 0.26$	0.5
(68350) 2001 MK3	1.67	0.25	29.56	$1.79 \pm 0.33$	$0.22 \pm 0.11$	1955-2007	$0.34 \pm 0.32$	1.1
2003 UN12	2.16	0.40	6.91	$1.25 \pm 0.25$	$0.05 \pm 0.02$	2003-2012	$0.34 \pm 0.25$	0.8

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
(8201) 1994 AH2	2.54	0.71	9.56	$1.86 \pm 0.18$	$0.15 \pm 0.04$	1981-2010	$0.34 \pm 0.27$	0.6
(85818) 1998 XM4	1.66	0.42	62.72	$2.22 \pm 0.02$	$0.21 \pm 0.03$	1993-2012	$0.33 \pm 0.29$	1.1
(27346) 2000 DN8	1.87	0.40	36.95	$1.75 \pm 0.10$	$0.26 \pm 0.04$	1978-2011	$0.33 \pm 0.29$	0.9
(247156) 2000 YH29	2.22	0.53	21.84	$1.97 \pm 0.21$	$0.03 \pm 0.01$	2000-2010	$0.32 \pm 0.27$	0.7
(153271) 2001 CL42	1.56	0.40	21.65	$2.44 \pm 0.17$	$0.04 \pm 0.01$	2001-2011	$0.32 \pm 0.22$	1.1
(241596) 1998 XM2	1.80	0.34	27.10	$1.56 \pm 0.02$	$0.10 \pm 0.02$	1952-2011	$0.31 \pm 0.23$	0.9
2006 JT	2.40	0.48	36.42	$1.52 \pm 0.32$	$0.02 \pm 0.01$	2006-2010	$0.31 \pm 0.28$	0.6
(85804) 1998 WQ5	1.72	0.35	27.66	$2.37 \pm 0.44$	$0.24 \pm 0.09$	1989-2011	$0.30 \pm 0.24$	0.9
(5653) Camarillo	1.79	0.30	6.87	$1.54 \pm 0.02$	$0.27 \pm 0.06$	1974-2012	$0.30 \pm 0.23$	0.9
2010 LO97	2.58	0.53	21.66	$1.63 \pm 0.31$	$0.02 \pm 0.01$	182 days	$0.29 \pm 0.26$	0.5
2009 WF104	3.07	0.66	17.00	$2.23 \pm 0.03$	$0.05 \pm 0.01$	2009-2010	$0.29 \pm 0.22$	0.4
(153249) 2001 BW15	2.12	0.59	41.21	$3.16 \pm 0.73$	$0.18 \pm 0.11$	1989-2010	$0.29 \pm 0.21$	0.7
(154029) 2002 CY46	1.89	0.46	44.16	$2.23 \pm 0.05$	$0.10 \pm 0.02$	2002-2010	$0.29 \pm 0.24$	0.8
(159518) 2001 FF7	2.10	0.44	47.51	$1.78 \pm 0.03$	$0.04 \pm 0.01$	2001-2010	$0.28 \pm 0.23$	0.6
(52387) 1993 OM7	1.28	0.19	24.15	$1.22 \pm 0.25$	$0.09 \pm 0.03$	1993-2009	$0.28 \pm 0.24$	1.4
(153842) 2001 XT30	2.74	0.57	9.07	$1.76 \pm 0.11$	$0.19 \pm 0.04$	2000-2011	$0.28 \pm 0.24$	0.4
(217807) 2000 XK44	1.72	0.39	11.24	$0.73 \pm 0.14$	$0.28 \pm 0.18$	1975-2009	$0.28 \pm 0.25$	0.9
(162038) 1996 DH	1.59	0.28	17.23	$1.96 \pm 0.22$	$0.11 \pm 0.03$	1996-2012	$0.28 \pm 0.20$	1.0
(85709) 1998 SG36	1.65	0.34	24.84	$2.23 \pm 0.14$	$0.14 \pm 0.03$	1998-2012	$0.27 \pm 0.24$	0.9
2005 QL	2.45	0.50	10.71	$1.85 \pm 0.44$	$0.02 \pm 0.01$	2005-2010	$0.27 \pm 0.25$	0.5
2010 EH20	2.62	0.52	23.89	$1.80 \pm 0.39$	$0.03 \pm 0.03$	2010-2010	$0.27 \pm 0.24$	0.4
(36183) 1999 TX16	1.55	0.33	38.22	$2.30 \pm 0.11$	$0.09 \pm 0.02$	1997-2008	$0.26 \pm 0.21$	1.0
(11066) Sigurd	1.39	0.38	36.89	$2.78 \pm 0.12$	$0.19 \pm 0.03$	1992-2012	$0.26 \pm 0.23$	1.1
(1620) Geographos	1.25	0.34	13.34	$3.90 \pm 0.40$	$0.19 \pm 0.02$	1951-2012	$0.26 \pm 0.22$	1.3
(4183) Cuno	1.98	0.63	6.70	$5.62 \pm 0.46$	$0.10 \pm 0.02$	1986-2012	$0.26 \pm 0.20$	0.7
(3199) Nefertiti	1.57	0.28	32.97	$3.10 \pm 0.90$	$0.10 \pm 0.10$	1982-2011	$0.26 \pm 0.24$	0.9
(5620) Jasonwheeler	2.16	0.42	7.86	$1.80 \pm 0.50$	$0.09 \pm 0.09$	1955-2011	$0.25 \pm 0.21$	0.6
(304153) 2006 OU10	1.75	0.35	33.70	$2.05 \pm 0.02$	$0.03 \pm 0.01$	2006-2011	$0.25 \pm 0.19$	0.8
(108519) 2001 LF	1.60	0.27	16.39	$2.31 \pm 0.46$	$0.02 \pm 0.01$	1989-2011	$0.25 \pm 0.20$	0.9
(234061) 1999 HE1	2.36	0.57	8.17	$2.90 \pm 0.02$	$0.02 \pm 0.00$	1999-2010	$0.24 \pm 0.18$	0.5

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$p_V$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2004 EB	3.13	0.66	21.36	$2.54 \pm 0.24$	$0.04 \pm 0.01$	1999-2010	$0.24 \pm 0.19$	0.3
2001 RX11	2.77	0.54	13.05	$1.82 \pm 0.04$	$0.04 \pm 0.01$	2001-2010	$0.24 \pm 0.19$	0.4
(1863) Antinous	2.26	0.61	18.40	$3.23 \pm 0.60$	$0.10 \pm 0.03$	1948-2009	$0.24 \pm 0.22$	0.5
(5645) 1990 SP	1.35	0.39	13.51	$1.67 \pm 0.02$	$0.12 \pm 0.02$	1974-2009	$0.24 \pm 0.18$	1.1
(285263) 1998 QE2	2.42	0.57	12.85	$2.75 \pm 0.55$	$0.06 \pm 0.02$	1998-2009	$0.24 \pm 0.18$	0.4
(276049) 2002 CE26	2.23	0.56	47.31	$3.33 \pm 0.95$	$0.03 \pm 0.03$	2001-2010	$0.23 \pm 0.21$	0.5
2010 LR68	3.03	0.61	4.58	$2.25 \pm 0.15$	$0.02 \pm 0.00$	2006-2011	$0.23 \pm 0.21$	0.3
(4957) Brucemurray	1.57	0.22	35.01	$3.10 \pm 0.60$	$0.17 \pm 0.06$	1976-2003	$0.23 \pm 0.20$	0.8
(138925) 2001 AU43	1.90	0.38	72.13	$2.41 \pm 0.50$	$0.11 \pm 0.03$	2001-2009	$0.22 \pm 0.19$	0.6
(5731) Zeus	2.26	0.65	11.43	$5.23 \pm 0.69$	$0.03 \pm 0.01$	1988-2006	$0.22 \pm 0.15$	0.5
(275611) 1999 XX262	1.53	0.18	8.23	$2.43 \pm 0.18$	$0.02 \pm 0.01$	1974-2010	$0.22 \pm 0.20$	0.8
(9950) ESA	2.44	0.53	14.59	$2.50 \pm 0.50$	$0.10 \pm 0.03$	1990-2009	$0.22 \pm 0.21$	0.4
(20460) Robwhiteley	1.88	0.41	33.94	$2.72 \pm 0.59$	$0.20 \pm 0.14$	1954-2009	$0.22 \pm 0.18$	0.6
(1685) Toro	1.37	0.44	9.38	$3.79 \pm 0.04$	$0.25 \pm 0.04$	1948-2010	$0.21 \pm 0.18$	0.9
(248590) 2006 CS	2.91	0.70	52.30	$4.73 \pm 0.84$	$0.02 \pm 0.01$	1996-2011	$0.21 \pm 0.18$	0.3
(6455) 1992 HE	2.24	0.57	37.36	$4.63 \pm 0.41$	$0.23 \pm 0.05$	1989-2012	$0.21 \pm 0.17$	0.4
(3122) Florence	1.77	0.42	22.16	$4.40 \pm 0.03$	$0.23 \pm 0.05$	1979-2012	$0.20 \pm 0.16$	0.6
(162998) 2001 SK162	1.93	0.47	1.68	$0.87 \pm 0.01$	$0.16 \pm 0.03$	1993-2009	$0.20 \pm 0.16$	0.5
(248926) 2006 WZ2	1.69	0.33	24.66	$2.91 \pm 0.23$	$0.04 \pm 0.01$	1998-2010	$0.20 \pm 0.18$	0.6
(11398) 1998 YP11	1.72	0.39	15.02	$1.32 \pm 0.35$	$0.32 \pm 0.10$	1983-2012	$0.19 \pm 0.21$	0.6
(4486) Mithra	2.20	0.66	3.04	$1.85 \pm 0.02$	$0.30 \pm 0.06$	1987-2011	$0.19 \pm 0.17$	0.4
(6178) 1986 DA	2.82	0.58	4.31	$3.20 \pm 0.21$	$0.16 \pm 0.03$	1977-2010	$0.19 \pm 0.17$	0.3
(248083) 2004 QU24	3.32	0.61	23.34	$2.36 \pm 0.51$	$0.13 \pm 0.07$	1993-2011	$0.19 \pm 0.16$	0.2
(5626) 1991 FE	2.20	0.45	3.85	$3.96 \pm 1.22$	$0.15 \pm 0.15$	1970-2011	$0.19 \pm 0.19$	0.4
(100085) 1992 UY4	2.64	0.63	2.80	$2.60 \pm 0.70$	$0.02 \pm 0.02$	1979-2006	$0.19 \pm 0.17$	0.3
(1866) Sisyphus	1.89	0.54	41.19	$6.60 \pm 0.19$	$0.26 \pm 0.05$	1955-2012	$0.18 \pm 0.12$	0.5
2001 RC12	3.22	0.64	27.33	$3.20 \pm 0.40$	$0.08 \pm 0.02$	2001-2007	$0.17 \pm 0.16$	0.2
2009 XE11	3.31	0.61	14.07	$2.72 \pm 0.02$	$0.04 \pm 0.01$	1997-2010	$0.17 \pm 0.16$	0.2
(4015) Wilson-Harri	2.64	0.62	2.78	$3.82 \pm 0.03$	$0.05 \pm 0.01$	1949-2011	$0.17 \pm 0.13$	0.3
(152679) 1998 KU2	2.25	0.55	4.92	$4.69 \pm 1.18$	$0.02 \pm 0.01$	1998-2010	$0.16 \pm 0.24$	0.3

Table 4—Continued

NEA	$a$ (AU)	$e$	$i$ (deg)	$D$ (km)	$pV$	Arc	$da/dt$ $10^{-4}$ AU/Myr	$\Delta\rho$ (km)
2009 WO6	3.09	0.58	28.76	$2.49 \pm 0.01$	$0.03 \pm 0.01$	121 days	$0.16 \pm 0.14$	0.2
2010 LF86	2.41	0.46	13.54	$2.51 \pm 0.20$	$0.03 \pm 0.01$	2010-2011	$0.16 \pm 0.13$	0.3
(5646) 1990 TR	2.14	0.44	7.91	$2.72 \pm 0.53$	$0.45 \pm 0.19$	1990-2006	$0.16 \pm 0.13$	0.3
(163691) 2003 BB43	2.41	0.52	40.89	$3.45 \pm 0.54$	$0.02 \pm 0.01$	1988-2007	$0.15 \pm 0.13$	0.3
(2368) Beltrovata	2.10	0.41	5.24	$3.00 \pm 0.49$	$0.16 \pm 0.08$	1977-2012	$0.14 \pm 0.13$	0.3
(4055) Magellan	1.82	0.33	23.24	$2.78 \pm 0.15$	$0.33 \pm 0.07$	1985-2012	$0.14 \pm 0.10$	0.4
(96189) Pygmalion	1.82	0.31	13.99	$3.61 \pm 0.16$	$0.04 \pm 0.01$	1986-2011	$0.13 \pm 0.10$	0.4
(162566) 2000 RJ34	2.63	0.57	13.85	$4.33 \pm 0.10$	$0.07 \pm 0.01$	2000-2010	$0.13 \pm 0.09$	0.2
(6050) Miwablock	2.20	0.44	6.40	$3.54 \pm 0.88$	$0.19 \pm 0.15$	1953-2012	$0.12 \pm 0.11$	0.3
(5587) 1990 SB	2.39	0.55	18.10	$4.86 \pm 0.85$	$0.25 \pm 0.11$	1953-2012	$0.12 \pm 0.11$	0.2
(3752) Camillo	1.41	0.30	55.55	$2.31 \pm 0.09$	$0.21 \pm 0.04$	1976-2003	$0.12 \pm 0.11$	0.5
(20826) 2000 UV13	2.42	0.63	31.87	$5.10 \pm 1.00$	$0.27 \pm 0.09$	1953-2012	$0.11 \pm 0.10$	0.2
(54789) 2001 MZ7	1.78	0.29	24.46	$1.57 \pm 0.02$	$0.86 \pm 0.14$	1978-2011	$0.11 \pm 0.10$	0.3
(52762) 1998 MT24	2.42	0.65	33.88	$6.74 \pm 0.19$	$0.05 \pm 0.01$	1953-2008	$0.10 \pm 0.08$	0.2
(5370) Taranis	3.33	0.63	19.09	$5.33 \pm 0.08$	$0.04 \pm 0.01$	1986-2011	$0.10 \pm 0.09$	0.1
(19764) 2000 NF5	2.23	0.44	1.33	$1.57 \pm 0.07$	$0.34 \pm 0.08$	1990-2012	$0.09 \pm 0.08$	0.2
(88263) 2001 KQ1	2.10	0.43	38.83	$5.71 \pm 0.03$	$0.04 \pm 0.01$	1998-2008	$0.09 \pm 0.07$	0.2
(1580) Betulia	2.20	0.49	52.11	$5.39 \pm 0.54$	$0.08 \pm 0.01$	1950-2010	$0.09 \pm 0.07$	0.2
(17274) 2000 LC16	2.72	0.56	5.62	$3.18 \pm 0.11$	$0.04 \pm 0.01$	1955-2011	$0.08 \pm 0.07$	0.1
(1980) Tezcatlipoca	1.71	0.36	26.86	$5.99 \pm 0.08$	$0.14 \pm 0.02$	1950-2012	$0.08 \pm 0.07$	0.3
(26760) 2001 KP41	2.87	0.55	10.91	$5.40 \pm 0.37$	$0.04 \pm 0.01$	1996-2011	$0.08 \pm 0.06$	0.1
(25916) 2001 CP44	2.56	0.50	15.75	$5.68 \pm 0.03$	$0.26 \pm 0.05$	1973-2012	$0.07 \pm 0.06$	0.1
(143651) 2003 QO104	2.13	0.53	11.62	$2.29 \pm 0.54$	$0.14 \pm 0.14$	1981-2012	$0.07 \pm 0.07$	0.2
(1627) Ivar	1.86	0.40	8.45	$8.37 \pm 0.08$	$0.13 \pm 0.03$	1929-2012	$0.07 \pm 0.05$	0.2
(21088) 1992 BL2	1.71	0.24	38.46	$4.23 \pm 0.11$	$0.21 \pm 0.05$	1990-2012	$0.05 \pm 0.04$	0.2
(3691) Bede	1.77	0.28	20.36	$1.80 \pm 0.11$	$0.59 \pm 0.12$	1975-2012	$0.04 \pm 0.03$	0.1
(887) Alinda	2.48	0.57	9.36	$4.79 \pm 0.23$	$0.34 \pm 0.06$	1918-2008	$0.03 \pm 0.03$	0.1
(16064) Davidharvey	2.85	0.59	4.54	$4.11 \pm 0.59$	$0.02 \pm 0.01$	1994-2009	$0.02 \pm 0.02$	0.0
(433) Eros	1.46	0.22	10.83	$33.60 \pm 0.12$	$0.25 \pm 0.06$	1893-2012	$0.02 \pm 0.01$	0.1
(1036) Ganymed	2.66	0.53	26.70	$36.75 \pm 0.31$	$0.23 \pm 0.03$	1924-2012	$0.01 \pm 0.01$	0.0



